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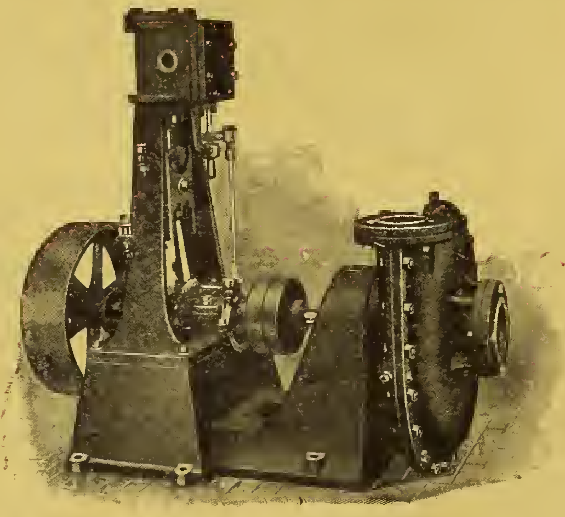
Vol. 28 Toronto, July 1, 1914 No. 26

Contract Record and Engineering Review

ESTABLISHED 1886

Smart-Turner Pumps

are in the first rank.



Steam Engine Driven Centrifugal Pump

Centrifugal Bilge and Sump Pump.

They are favorably known from Vancouver to Halifax.

There is no larger factory in Canada devoting their entire energies to the manufacture of pumping machinery.

Estimates furnished on all classes of electrically driven, steam driven and centrifugal pumps.

The Smart-Turner Machine Co., Ltd.

Hamilton, Canada

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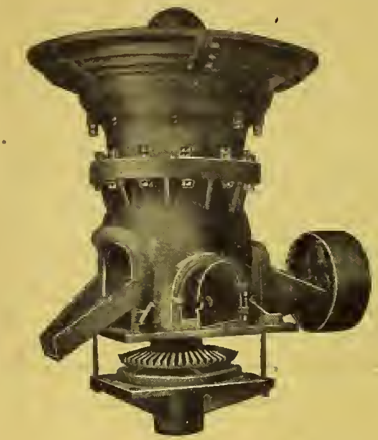


"Announcement"

In addition to a full line of other types of crushing machinery and equipment we are now building

Gyratory Crushers

of most modern design and equipped with an improved

Water Cooled Eccentric Bearing

Made in all sizes for all capacities and for crushing any kind of material.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catherines Toronto Montreal Cobalt South Porcupine
Vancouver and Nelson

Three Big Concrete Reservoirs built with

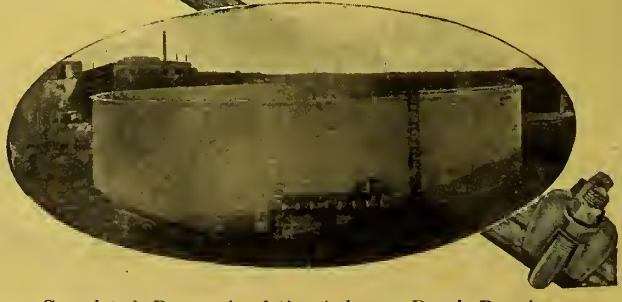
"CROSBY" CLIPS

The type of reinforced concrete reservoir recently built by the City of Duluth, the State of Illinois, and the Anheuser-Busch Brewing Company, has the merit of speedy, economical construction and extreme durability. The steel reinforcement consists of bars joined by **Genuine "Crosby" Clips.** It is capable of standing any strain that it is possible to throw upon the walls of the reservoir.

Portion of Steel Reinforcement of Duluth Reservoir

This type of reservoir places an ample water supply within the means of even the smallest towns, because the expense of original construction is not great—and there is practically no upkeep expense, as is the case with steel tanks and various other types of reservoirs.

Pouring Concrete, on Reservoir at Anna, Ill.



Completed Reservoir of the Anheuser-Busch Brewing Company, St. Louis, Mo.

MADE BY

American Hoist & Derrick Co.

ST. PAUL, MINN., U. S. A.

Sold by
Gorman, Clancey & Grindley—Edmonton, Calgary, Alta., and Nelson, B.C.
Vancouver Machinery Depot, Ltd.—Vancouver, B. C.
Stuart Machinery Co.—Winnipeg, Man.
General Supply Co. of Canada, Ltd.—Montreal, Ottawa, Toronto, Canada

Monolithic Concrete Highway Bridge—Lake Louis, Alta.

Small Concrete Bridges

The use of Concrete for small highway bridges has become so general that they have been constructed on practically every important road in the Dominion, especially on improved roads.

The use of Concrete has been brought about because of its superiority for this class of structures. Concrete is particularly adapted to bridges requiring special construction because of the fact that it may be moulded into any form and offers almost unlimited possibilities in obtaining artistic effects. Combined with this distinct advantage is its great strength, economy and permanence.

Economical and Durable

The economy of a Concrete Bridge begins with its construction. Its first cost is practically the only cost—its durability reduces upkeep to the minimun. Its construction means greater convenience to engineer and contractor because all of the materials may be obtained locally, which enables almost the entire cost to be returned to the rate payers of the district for cement, sand, stone or gravel, lumber, teams, and labor.

Write us for complete information about Concrete Bridges, large or small.

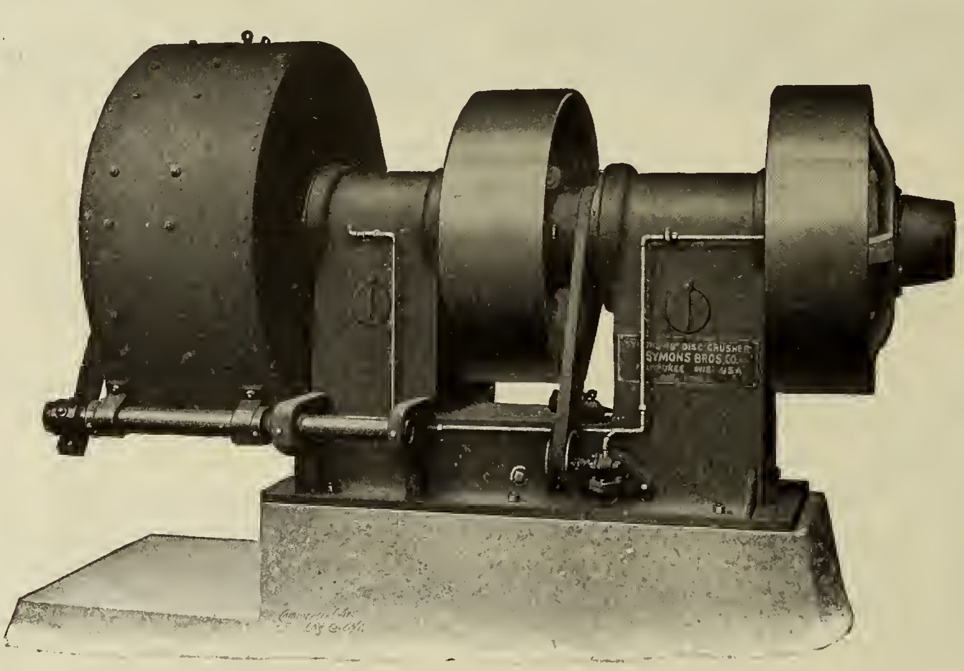
Information Department

Canada Cement Company Limited
885 Herald Building, Montreal

The Greatest Recrusher

The Symons Disc Crusher

**Excels in Economy of Power
in Uniformity of Product
in Low Repair Cost**



Capacities ranging from 40 tons of quarter inch to 1000 tons of two and a half inch per 10 hour day.

It gives the greatest amount of service at the least initial cost and expense of maintenance.

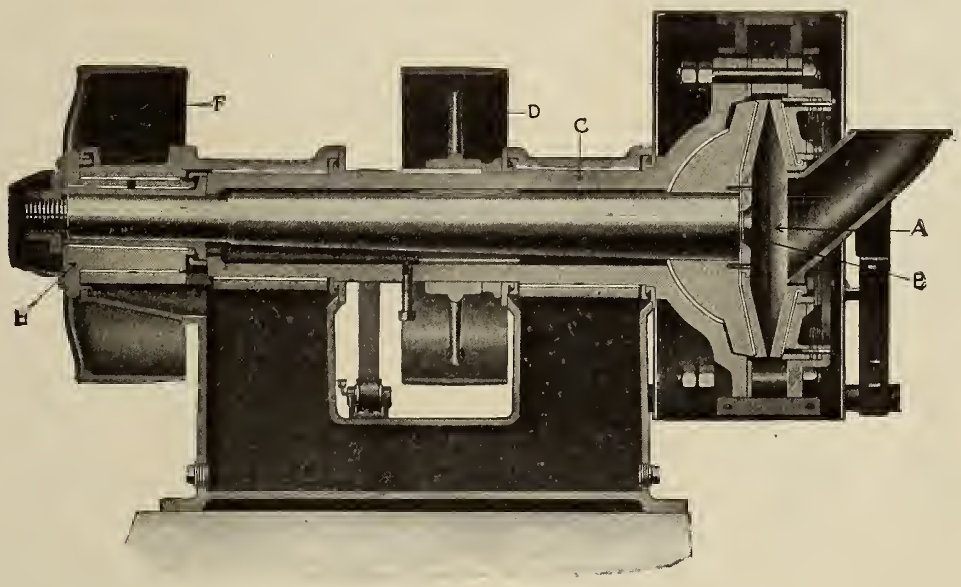
Symons Disc Crushers are made in Canada under our own supervision.

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
HALIFAX, 78 Granville St.

Symons Disc Crushers

Have a Crushing Principle which cannot be duplicated in any other machine



Sectional view of Symons Disc Crusher

The Symons is completely enclosed by hinged casings, preventing the escape of dust.

The Crushing Discs are made of Manganese Steel, and take up their own wear, wearing smooth—not in grooves. Their efficiency is not impaired until completely worn through, which insures a maximum length of service.

Catalogue Sent on Request

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.
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HALIFAX, 78 Granville St.

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The following regulations apply to all advertisers:—Eighth page, two headings quarter page, four headings; half page, eight headings; full page, sixteen headings.

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Hull Iron & Steel Foundries

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British Mfrs. Assn. of Canada.
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Canadian Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd.
Jenckes Machine Company

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Canadian Bridge Co.
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Railway Contractors Supply Co.

Concrete Machinery
Canadian Zagelmeyer Co.

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Badger Concrete Mixer Co.
Canadian Allis-Chalmers, Ltd.
Canadian Concrete Appliance Co.
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Jaeger Machine Company
Koehring Machine Co.
Knickerbocker Co.
Lecky & Collis
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Mills Bros.
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Rock & Power Machinery
Sutcliffe, Speakman & Co.
Wettlaufer Bros.

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Eastern Pipe Construction Co.
Foundation Company, Limited
Reggin & Spence
Wells & Gray

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Sutcliffe, Speakman & Co.
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Lecky & Collis
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Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 12)

Safety First!

A ROAD that is not dependable is a liability—not an asset. Patent pavements rely too much on the personal element for mixing and laying. But safety is assured if you specify

Bessemer Wire-Cut-Lug Block

It produces a road surface that will remain true, even and firm under all conditions. Bessemer Block roads are safe always—day or night, rain or shine. No treacherous mud or dangerous holes or inequalities. Affords a firm grip for all vehicles—motor or horse drawn.

Bessemer Paving Block is especially selected shale vitrified into a tough, durable, granite-like material that is ideal for road surfacing.

Let us send you our illustrated booklet on good roads—ask for it.

Bessemer Limestone Company, Youngstown, Ohio
Manufacturers of Bessemer Repressed and Dunn Wire-Cut-Lug Paving Block.

Canadian Agents { G. W. Essery, 47 Yonge Street Arcade Building, Toronto, Ontario
Stinson-Reeb Builders Supply Co., Montreal, Quebec

Pilkington's Window Glass

BRITISH * P. B. * CANADIAN · GLASS ·

The Brand of Quality

BRITISH POLISHED PLATE IN ALL SIZES

All descriptions of Window Glass may be obtained from our warehouses named below.

WIRED GLASS—The well known fire retardant. Made in three kinds: polished, ribbed and cast.
PRISMATIC—Ornamental, figured, rolled, etc.
WINDOW GLASS—For Buildings, Car and Horticultural purposes.

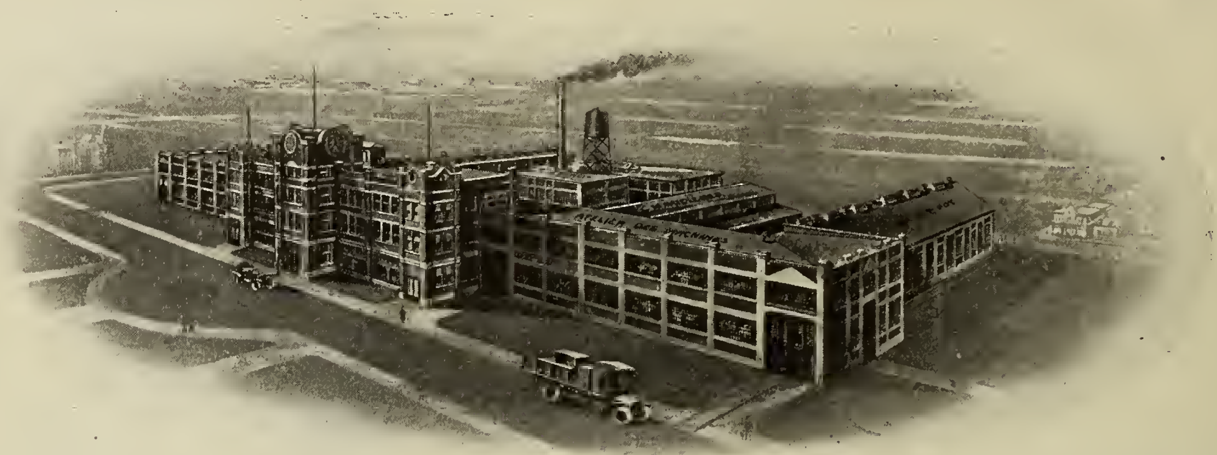
SPECIAL—We strongly recommend a trial of our 3rds quality window glass.

PILKINGTON BROS. LIMITED

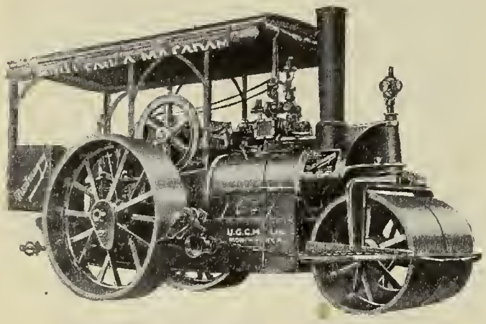
WORKS: ST. HELEN'S, LANCASHIRE, ENGLAND——THOROLD, ONTARIO, CANADA
WAREHOUSES: MONTREAL TORONTO WINNIPEG CALGARY VANCOUVER

General Car and Machinery Works, Limited

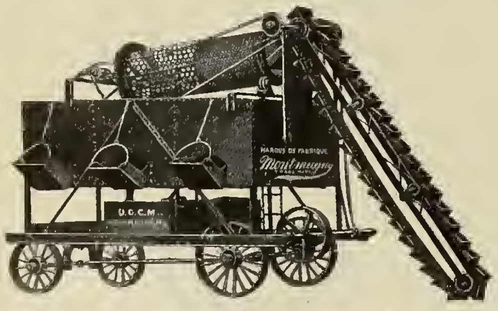
Quebec **MONTMAGNY, P.Q., Can.** **Montreal**



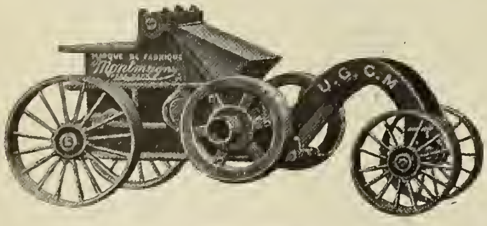
Head Office and Works



"Montmagny" Steam Road Roller.



"Montmagny" Portable Steel Bin.



"Montmagny" Stone Crushers.

"Montmagny"

Machinery

MODERN ROAD BUILDERS

The only firm in Canada specializing in Road Machinery and making the whole outfit.

WRITE US FOR CATALOGUE

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

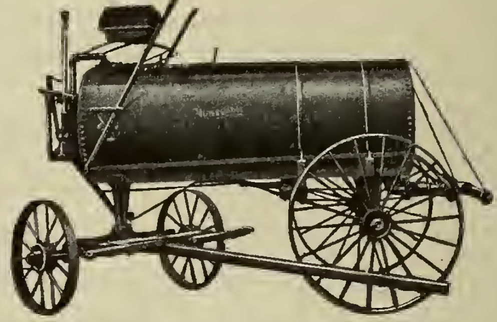
Double Cylinder, Double Bunker. Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature
"Power Steering"

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

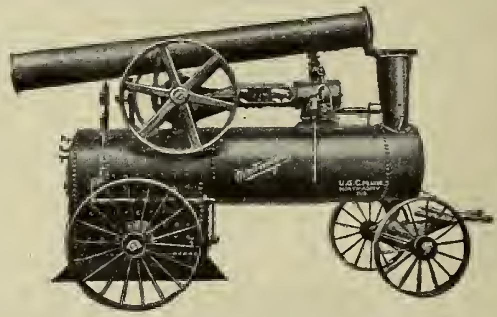
The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

For crushing field stone, granite, etc., "Montmagny" jaws are made of manganese steel. They stand the wear. For softer rock, chilled charcoal iron jaws are used. They are less expensive. Jaws may be reversed to wear both ends.



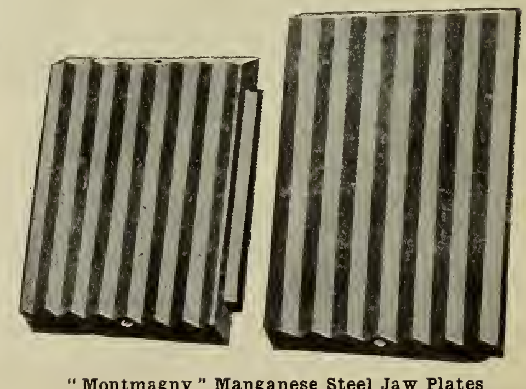
"Montmagny" Road Sprinkler.

The "Montmagny" all-steel road sprinkler specially adapted to the building of macadam roads. Has horizontal perforated pipe discharge, and is fitted with 4 in. cylinder feed pump and 2 in. suction hose.



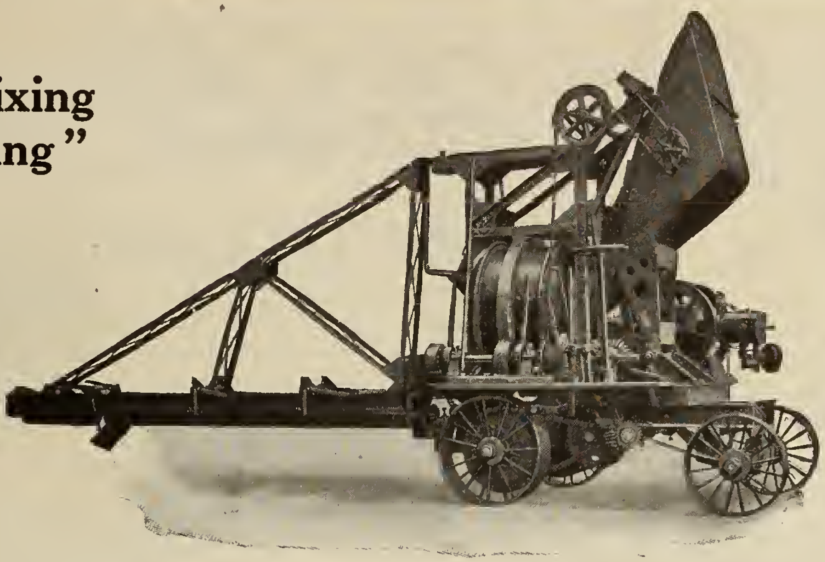
"Montmagny" Portable Steam Engine.

A portable centre crank engine and locomotive boiler mounted on wheels. Used for operating our "Montmagny" stone crusher or other machines. Made in 4 sizes, 15 to 30 h.p.



"Montmagny" Manganese Steel Jaw Plates

"Most Mixing
Least Fixing"



M-C Rail-Track Paver, with Gasoline Engine, showing 16 ft. Mixing Distributor.

12 H. P.—Steam or Gasoline.

M-C Rail-Track Paver

One man controls every operation from his station on the platform, without moving his feet or bending his back. It's so easy your engineers will "scrap" for the job.

When travelling this is the only paver that runs like a **road roller** or a **traction engine**; easily, fast or slow, any distance, up hill or down and always safe and sure. Never mind your horses—you don't need them.

When mixing—It leads the world. It's an **M-C Rail-Track Mixer**. "Nuf sed"!

Our new catalog tells all about it.

CANADIAN FAIRBANKS-MORSE CO., Ltd.

Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

Manufactured by

Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

MADE IN Sirocco **CANADA**

TRADE MARK,

A WORD FOR EFFICIENCY

"Sirocco" Multi-Blade Fan wheel built with capacities from 75 C.F.M. to 1,000,000 C.F.M. in single and double inlet types.

The word "**Sirocco**" applied to apparatus for Purifying—Cooling—Humidifying — Heating — Ventilating — Drying and Mechanical Draft stands for **a guarantee** of **highest efficiency.**

The "**Sirocco**" is the original fan of the many blade plan. **"Sirocco"** Fans save time over other types, because their design is such as to make use of **every bit** of energy with the least possible waste.

In specifying "Sirocco" Fans you're SURE they'll do exactly as claimed

A "Sirocco" Multi-Blade Fan will handle more air consuming less power than the ordinary steel plate fan twice the diameter.

Upon request we will gladly send to you a complete set of our Bulletins and Catalogues

Sales Engineers:

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301 McGill Bldg.,
Montreal

E. C. POWERS
43 Victoria St.,
Toronto

CANADIAN Sirocco COMPANY
LIMITED
WINDSOR. ONTARIO.

Sales Engineers:

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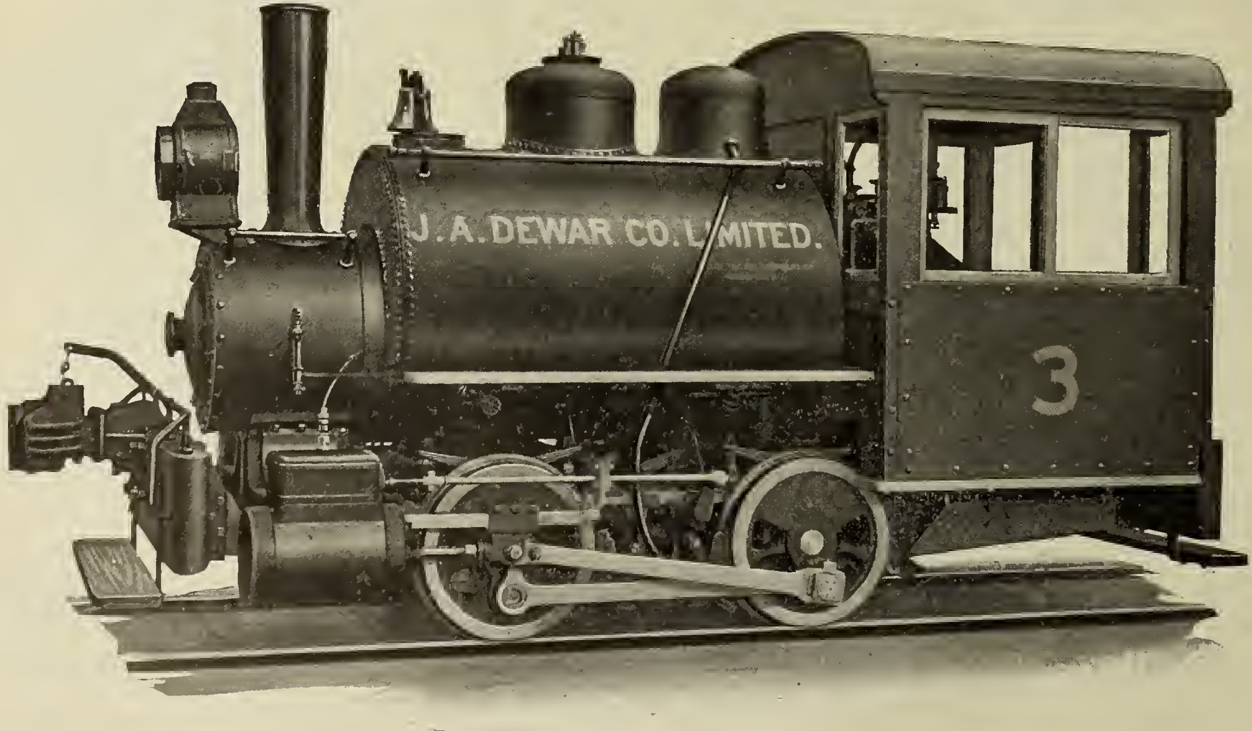
301 Tribune Bldg.,
Winnipeg

S. S. CLARKE
605 - 2nd St.,
Calgary

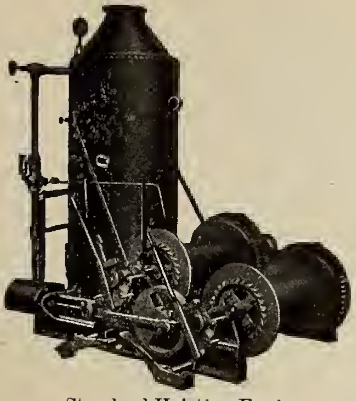
CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG



Standard Hoisting Engine

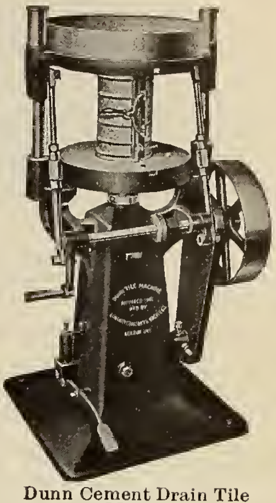
The London Concrete Machinery Co., Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES :
WINNIPEG—565 Portage Ave.—W. H. Rosevear, Manager.
CALGARY—622 9th Ave. West—P. D McLaren, Manager.
TORONTO—112 York Street—G. B. Oland, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

AGENCIES
Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Port Arthur and Fort William, Ont.—Northern Agency & Equipment Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

the Largest Manufacturers of Concrete Machinery in Canada



Dunn Cement Drain Tile Machine

Concrete Mixers

—

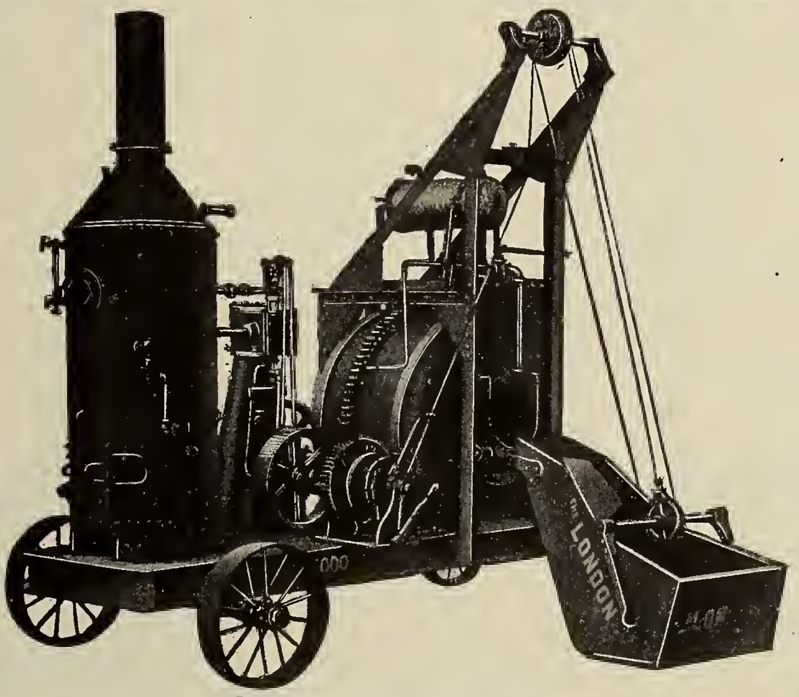
Mortar Mixers

—

Concrete Block Machines

—

Cement Brick Machines



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

—

Rock Crushers

—

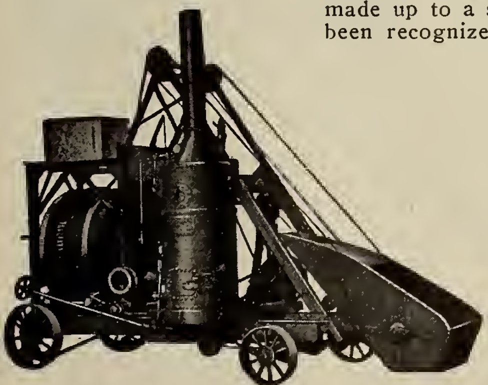
Pumping Outfits

—

Hoists and Derricks

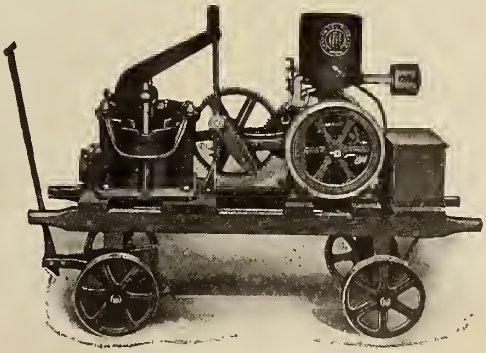
Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.



Rear Discharge Paving Machine with Forward Loader.

Correspondence Solicited.



Diaphram Pump with Power

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American Water Softener Co.

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Smyth & Ryan

Fire Escapes
Manitoba Bridge & Iron Works
McGregor & McIntyre

Fireproof Floors
Keystone Fireproofing Company of Canada

Fireproof Doors and Windows
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Pedlar People Limited
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Forgings
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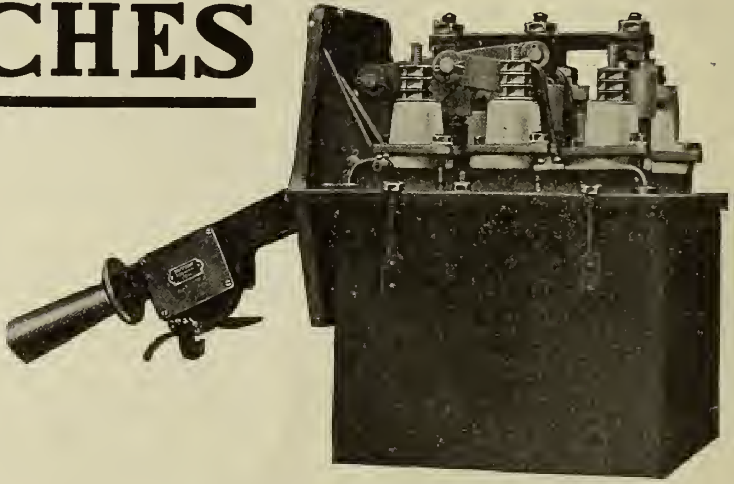
OIL SWITCHES

Since the earliest days of electricity supply

FERRANTI

practice has lead the way.



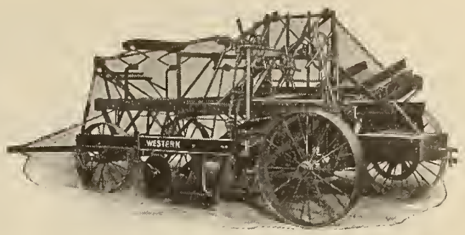
We have oil switches of all capacities between
25 amps. and 6,000 amps.
in service in Canada.

The Ferranti Electrical Co. of Canada, Ltd.

Head Office:—90 Sherbourne St., TORONTO
Branches:—704 Unity Bldg., MONTREAL
Farmers Advocate Bldg., WINNIPEG

If you are not using
"ABRAM"
TOOLS
It is plain to be seen
you are
losing money

Abram Cement Tool Co.,
Windsor, Ontario



The Western Elevating Grader

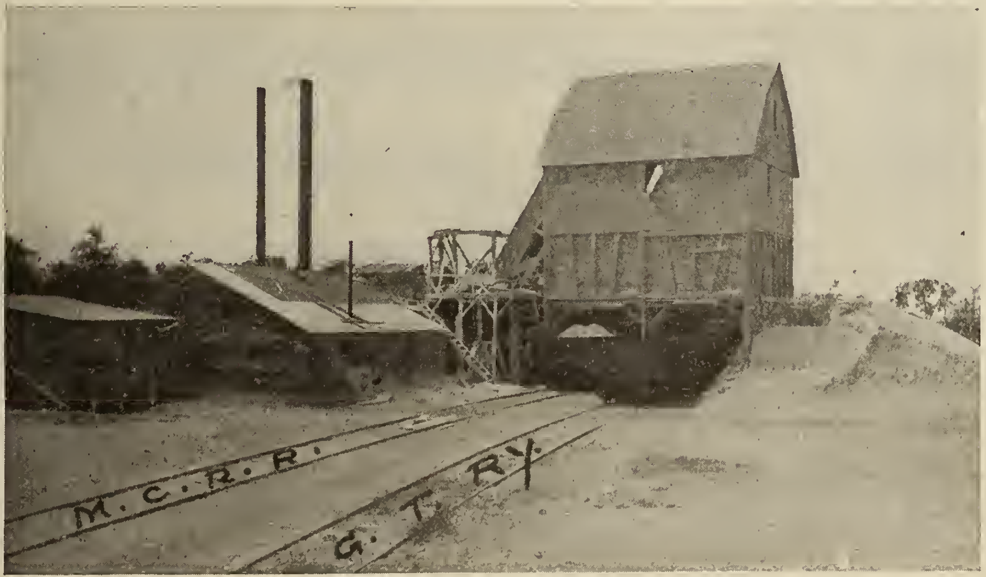
is especially recommended for excavating canals, ditches and reservoirs, loading wagons, building levees and embankments and throwing up roadways.

Numbers of these graders are in use on railroad work and in building canals, and have been adopted by many contractors and highway officials engaged in earth handling.

If you have an excavating proposition in view, we invite you to write for our illustrated catalogue.

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads



must be built of a
Tough Stone
that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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Plate Glass
Excelsior Plate Glass Co.
Pilkington Bros.

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Star Dump Wagons—made with plain or roller bearings—comprise the following essential qualities of construction and operation:—
Handmade white oak spokes.
Black birch hubs—A grade rims.
Sheldon square steel axles.
Iron work wrought and drop steel forgings.
Short wheel base—most efficient draft from front axle.
Strong winding arbor and foot trip—Boiler plate armored neck.

Write for prices and Catalog.

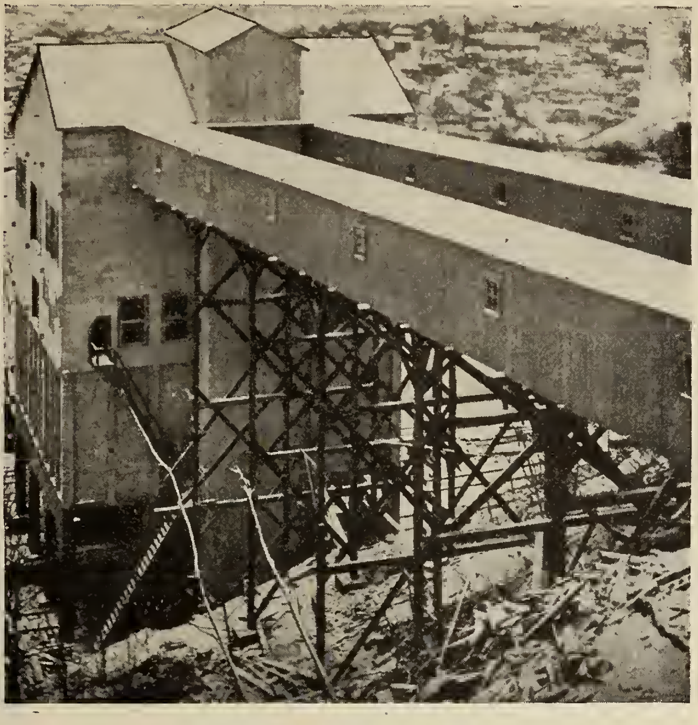
Why Some Contractors Make Money

Because they use the most economical equipment.

Star Dump Wagons built for every service will save you 30 to 40 per cent. of your hauling expense. The Roller Bearing wagons will handle 3 yards as easily as 2 yards with the same team.

The Canadian Fairbanks-Morse Co., Limited
Montreal Toronto Quebec Ottawa St. John Hamilton Ft. William
Winnipeg Calgary Regina Edmonton Saskatoon Vancouver Victoria

Canada's Departmental House for Mechanical Goods



Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

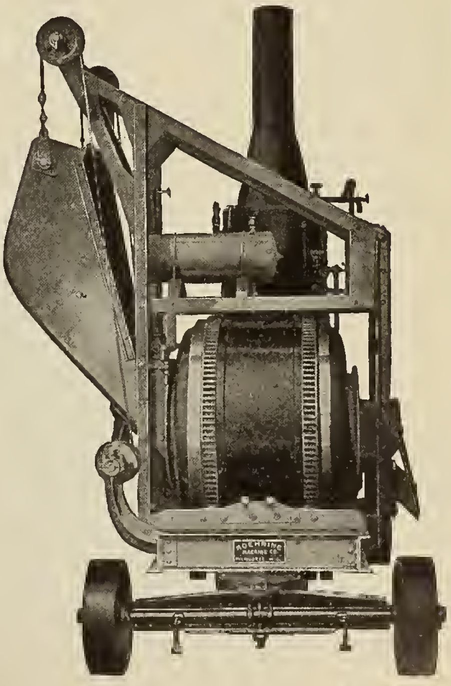
So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa



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Can. Supply & Contracting Co.
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Wrenches
Canadian Bilings & Spencer, Ltd.

Barrett Specification Roofs

Last Longest—Cost Least

THE proper unit in comparing the values of roofings is the cost-per-foot-per-year-of-service.

To have a low unit cost a roofing must be—

1st. Inexpensive to build,
2d. Inexpensive to maintain, and
3d. Of great durability.

Barrett Specification Roofs are—

1st. The *least* expensive of all permanent roofs to build,
2d. They cost *nothing* to maintain and
3d. They usually last, without repairs or leaks, *20 years* or over.

The net result of these three factors is a unit cost of about ¼c. per foot per year of service. This is a lower unit cost than ever attained by any other class of roofing.

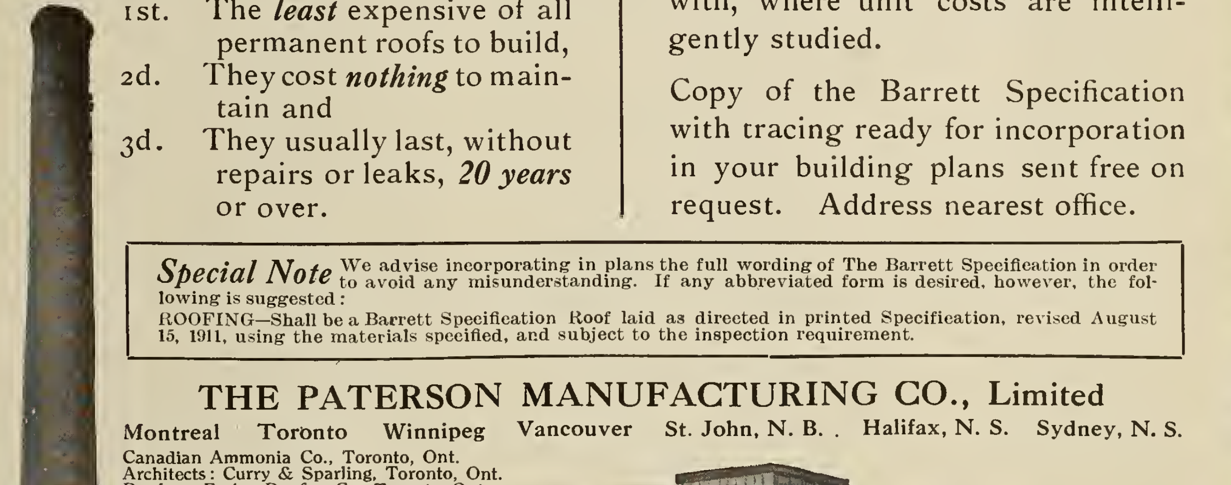
Accordingly, Barrett Specification Roofs are in almost universal use on buildings such as illustrated herewith, where unit costs are intelligently studied.

Copy of the Barrett Specification with tracing ready for incorporation in your building plans sent free on request. Address nearest office.

Special Note We advise incorporating in plans the full wording of The Barrett Specification in order to avoid any misunderstanding. If any abbreviated form is desired, however, the following is suggested:
ROOFING—Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified, and subject to the inspection requirement.

THE PATERSON MANUFACTURING CO., Limited

Montreal Toronto Winnipeg Vancouver St. John, N. B. Halifax, N. S. Sydney, N. S.



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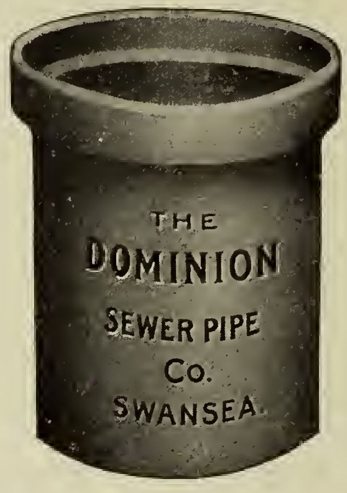

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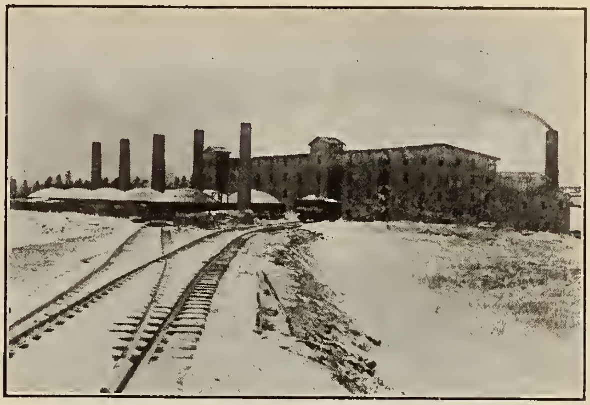

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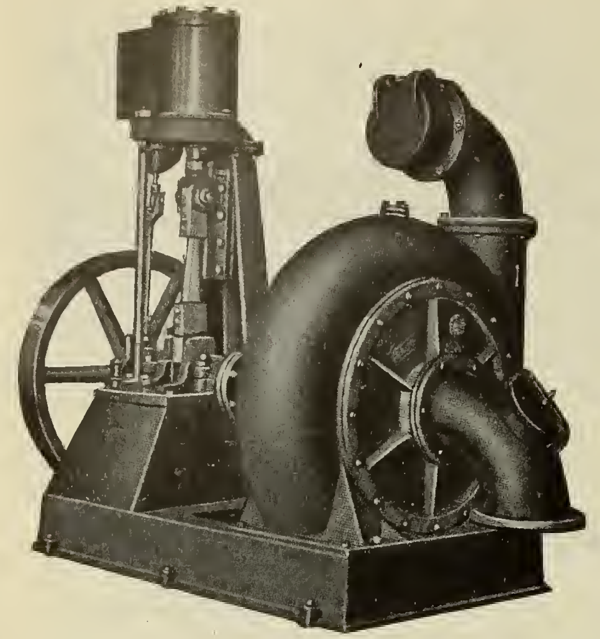

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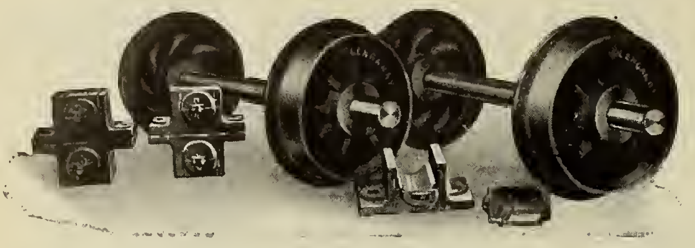

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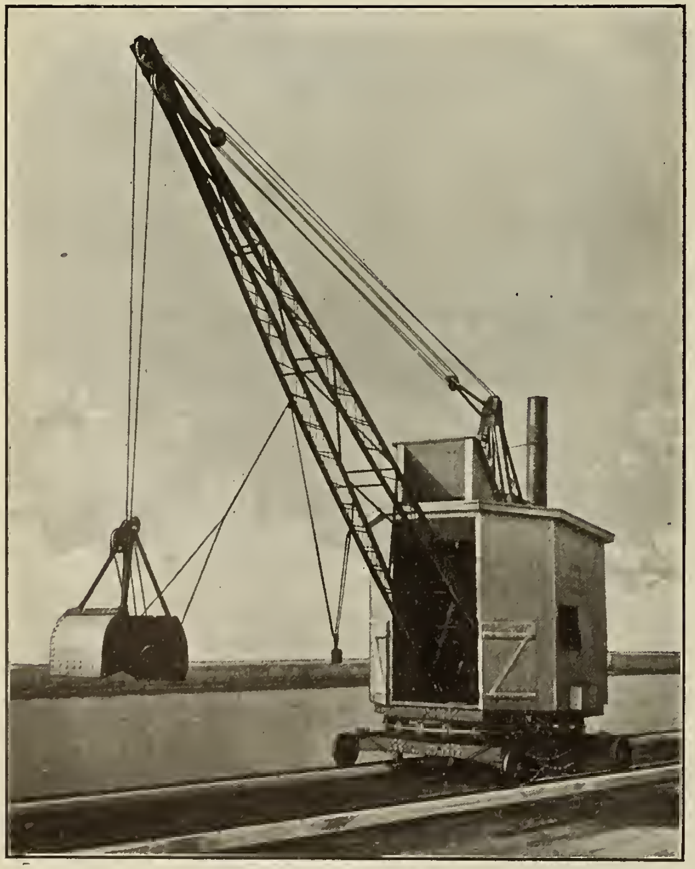

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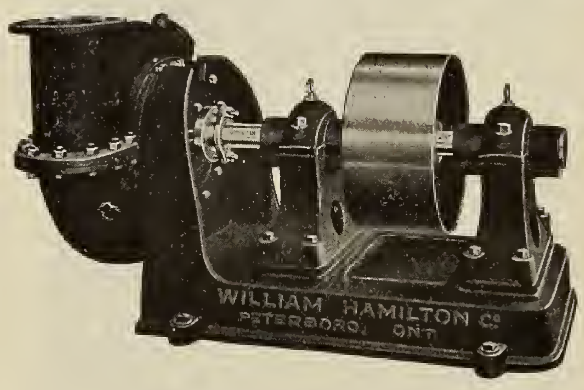

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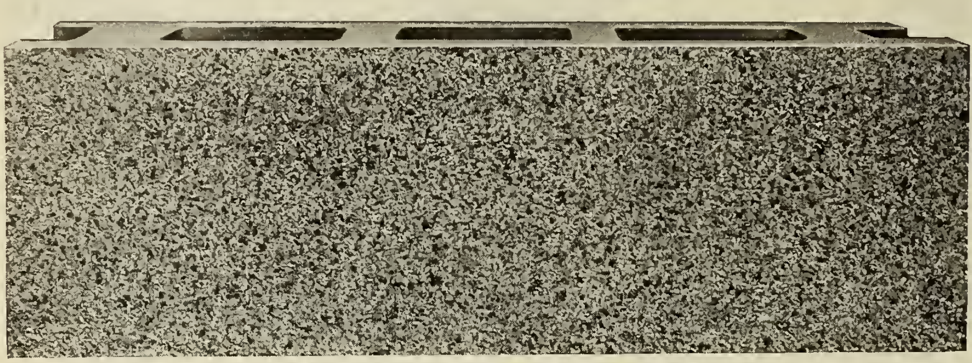

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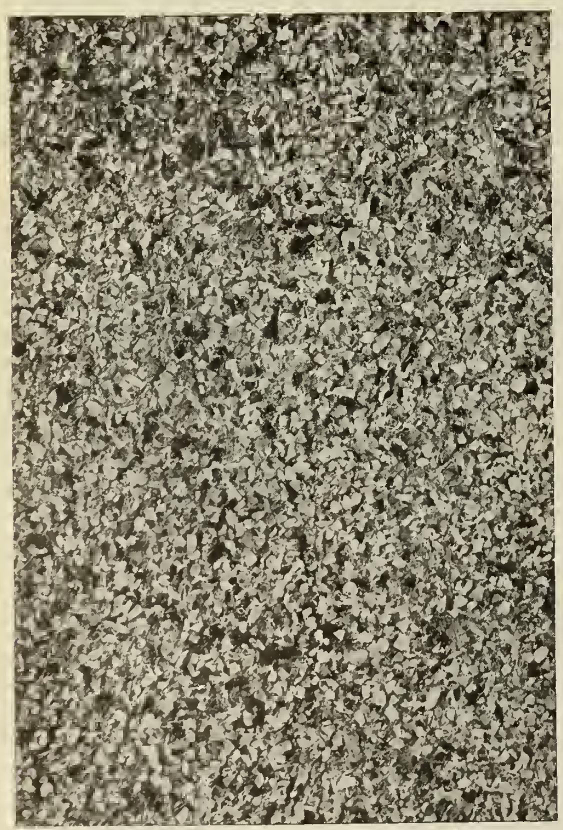

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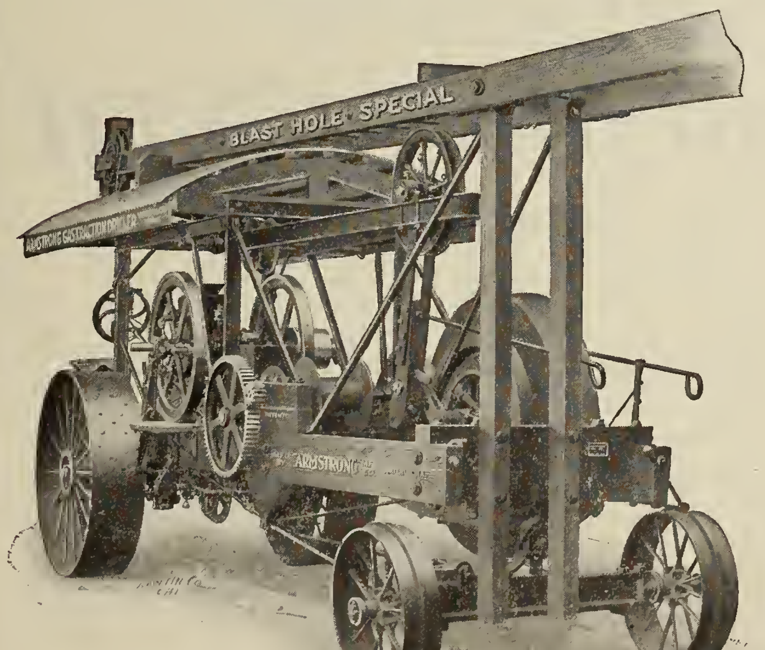

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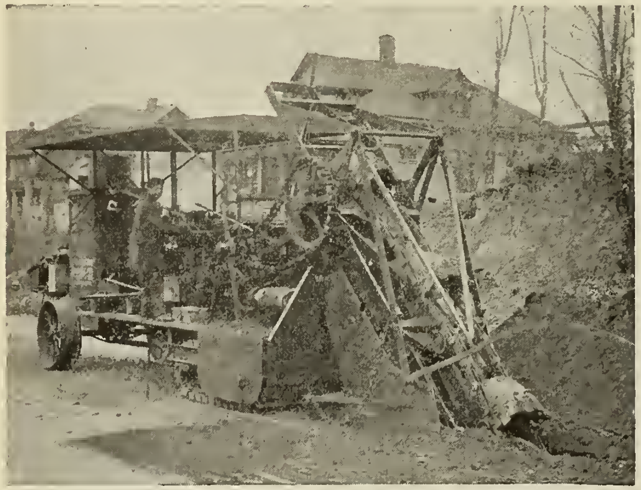

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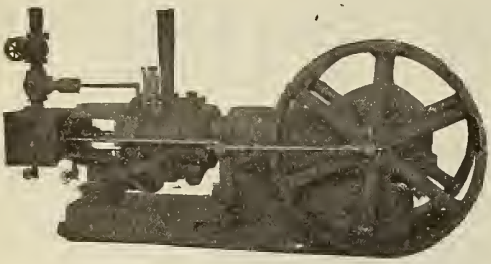

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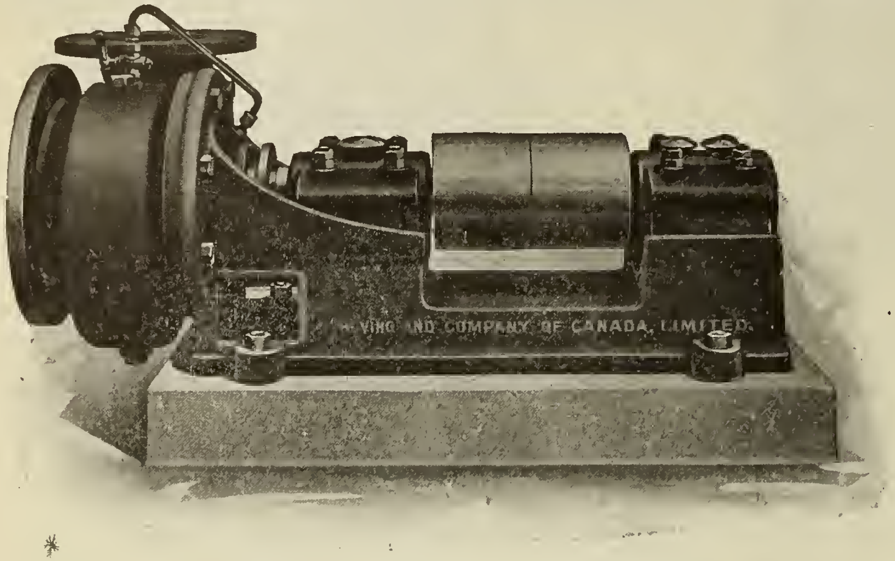

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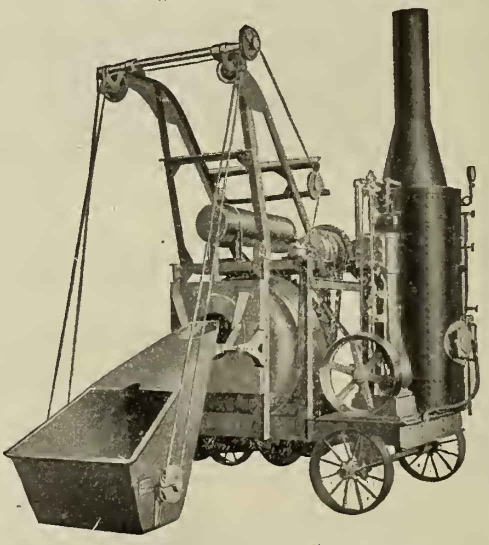

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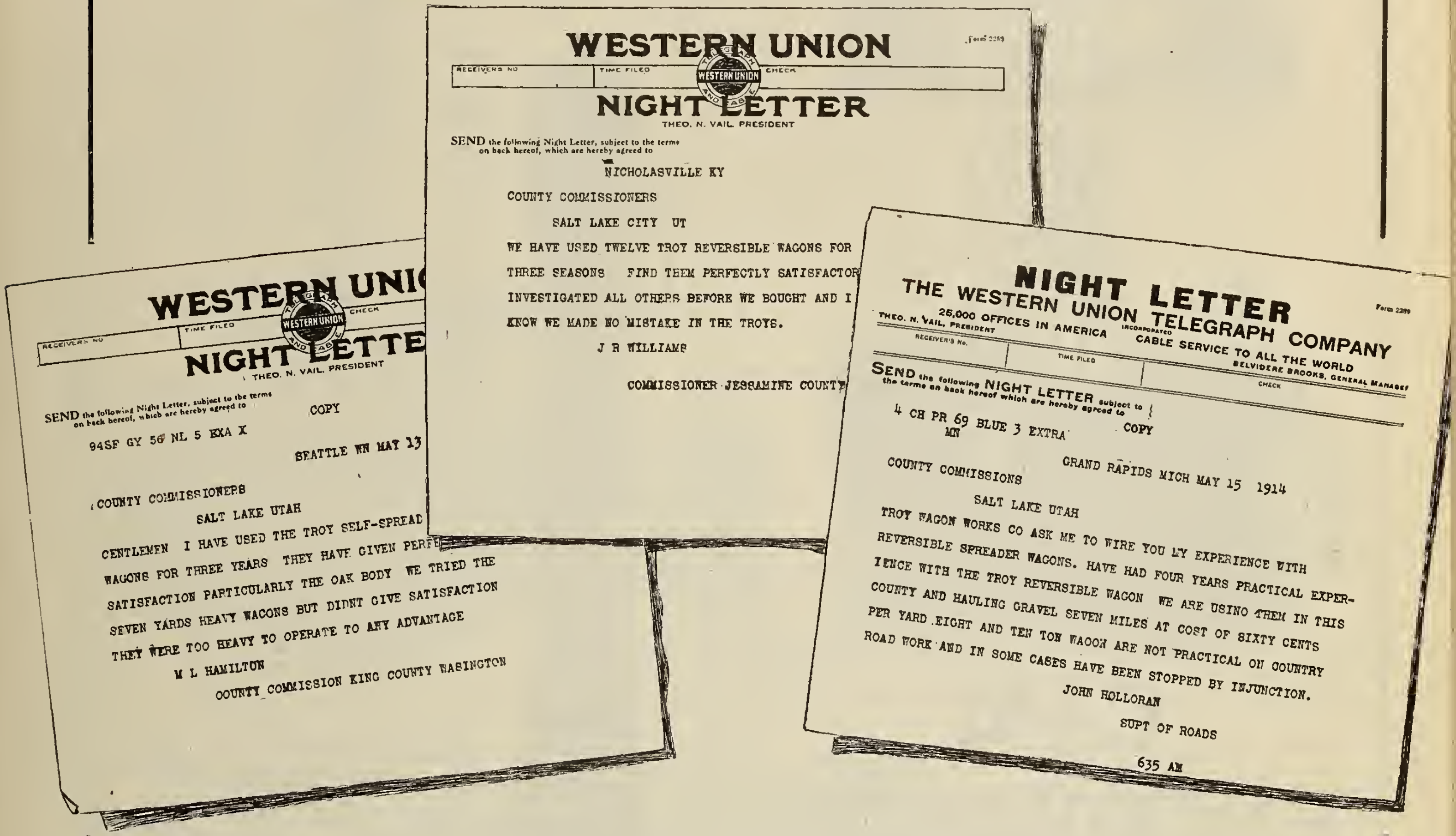

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JOHN HOLLORAN

SUPT OF ROADS

635 AM

—Giving some opinions regarding

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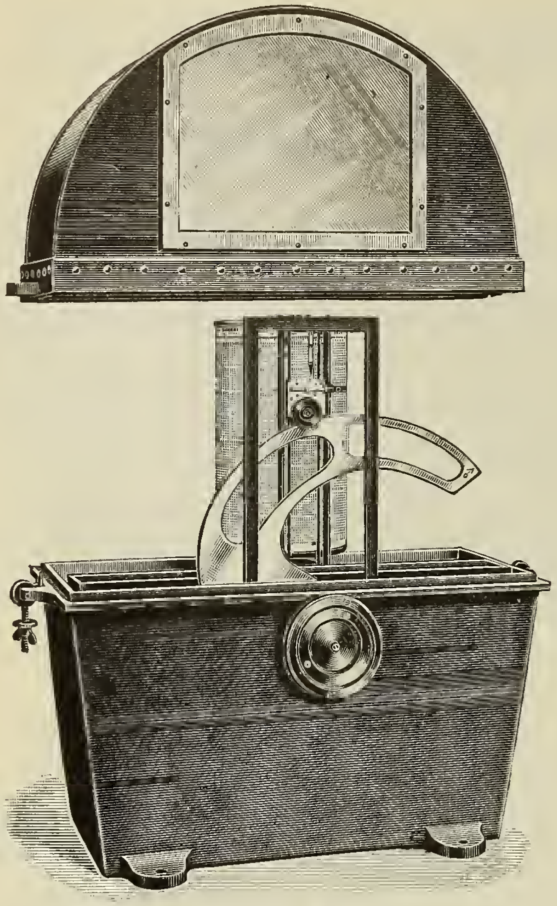

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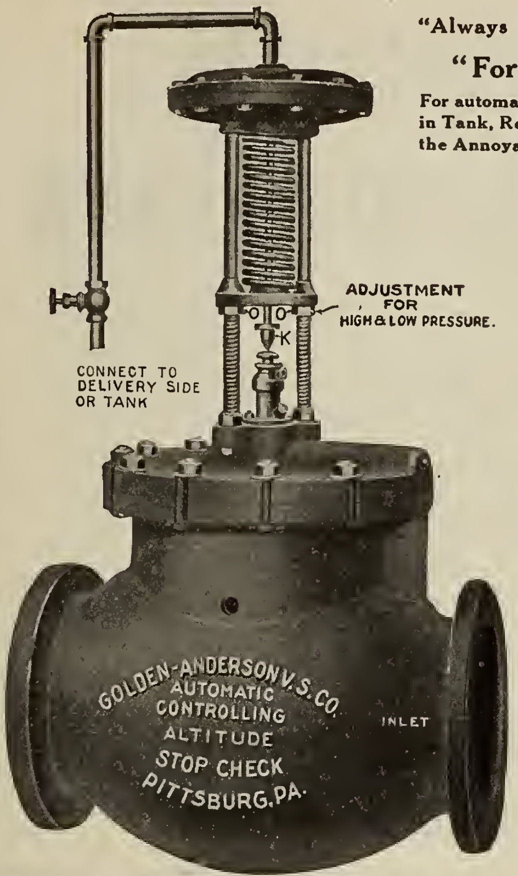

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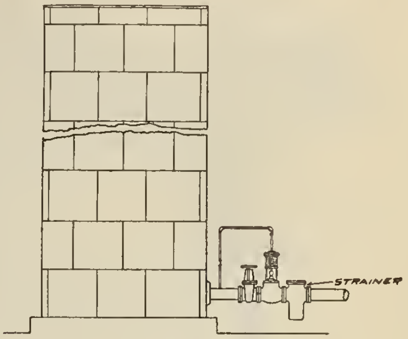

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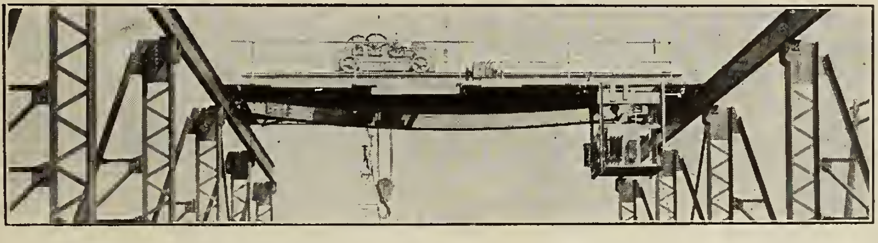

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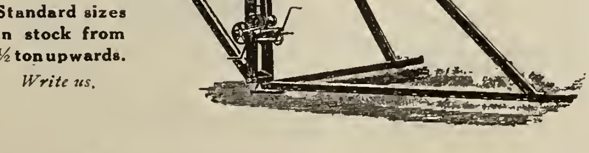

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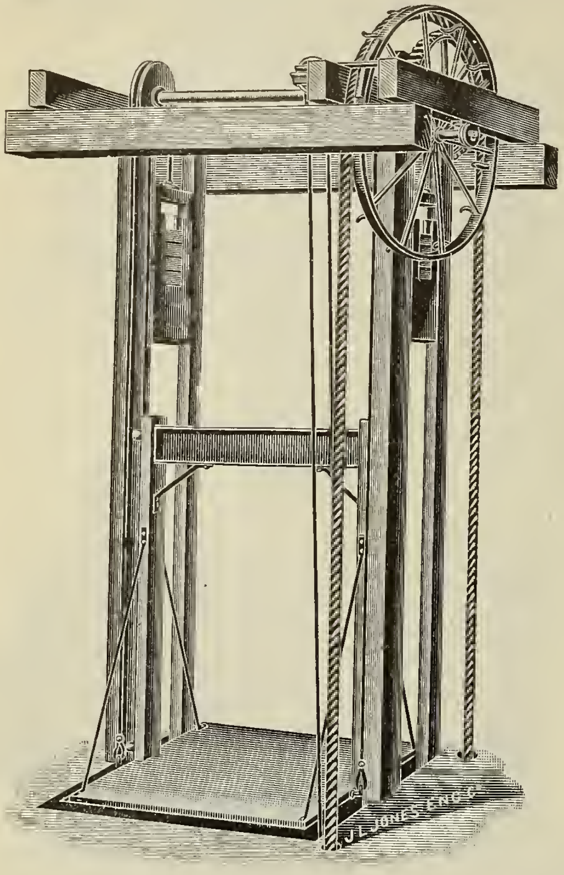
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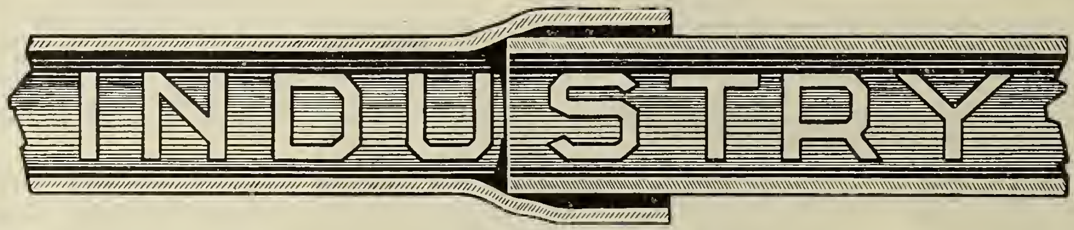

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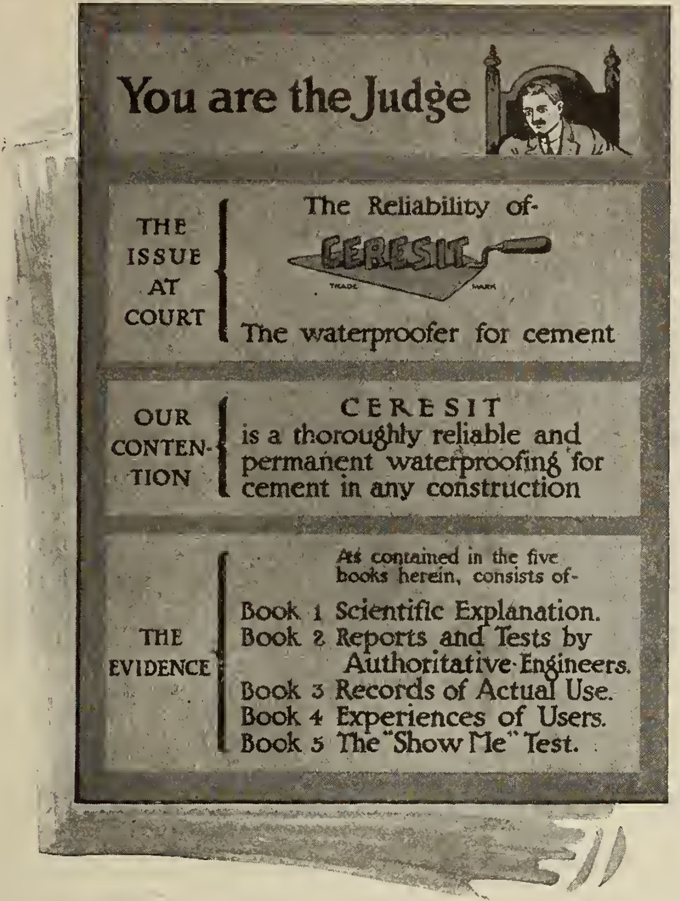
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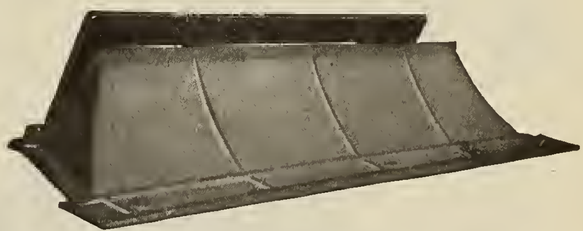

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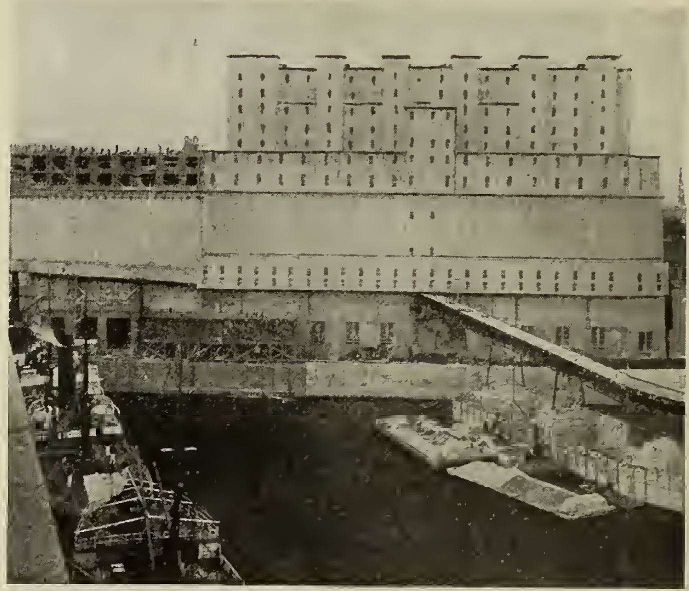

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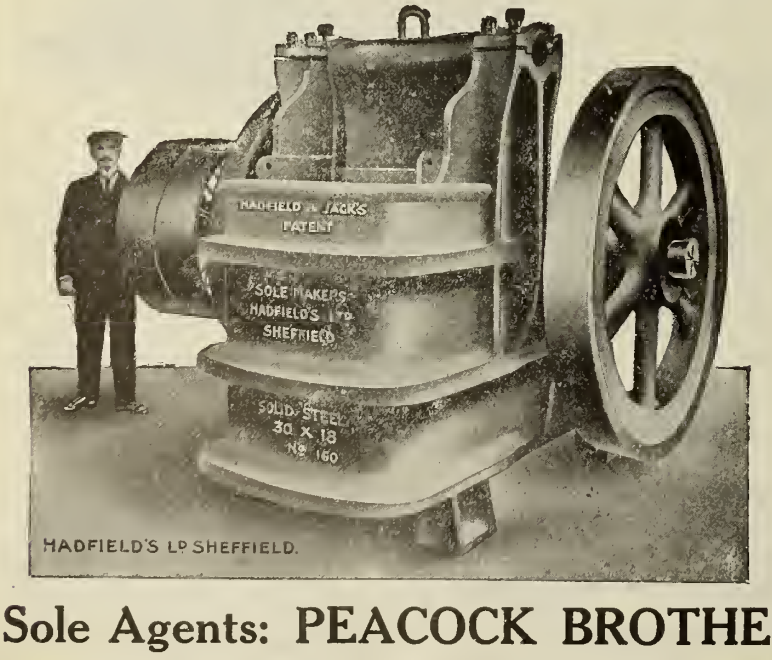
Hadfield's Patent

STONE BREAKER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ESTABLISHED 1886

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The Season of Speech

SPEECH has no season. The need of some method of concealing thought is ever a pressing one, and speech is a method which never fails. The loquacity of silence is too earnest, too deep, for everyday purposes. Commonplaces, forced sentiments, truisms (and other falsities), vapidities and conventional phrasings roll well off the tongue; and it is questionable whether their due presentment were possible by any other vehicle. To commit one's thoughts to cold print is to risk fame, for print is in its way imperishable and may rise in testimony at any moment. Speech is transitory, of the moment, and every word that has been uttered may be discovered. Speech (or sound) and false coin are, by the way, the only things to which the word "utter" is applied, and the analogy is obvious. There is, of course, ever the risk that one's words may be taken down by some zealous reporter and used in adverse evidence; but the intricate system of hooks and dots and halvings for which Pitman is responsible may always be urged as a plea for exculpation, and leavened with a dart of virtuous indignation will result unfailingly in a verdict of not guilty.

So much by way of preliminary flourish, from which the reader may draw what moral he pleases. There is a certain engineering institution in London, which has one very interesting unwritten law, viz., that at its social functions speech-making shall be taboo. The chairman is allowed, at the conclusion of the meal, to rise upon his feet, glass in hand, and say "The King," following it up immediately by "Gentlemen, you may smoke." Other institutions, other manners; and there are not wanting those—indeed, they are in a huge majority—which prepare lengthy toast lists, with dual responses, in which every possible opportunity is afforded for gentlemen to "say a few words." Three loyal toasts (necessarily without response) are not uncommon, and chairman, visitors,, kindred societies, secretary, the ladies, the press, mayor and corporation, and the city follow in heterogeneous profusion. Interspersed among these toasts are musical items provided by ladies and gentlemen of mediocre talent for the relief of a bored audience whose patience would become absolutely exhausted were it not for this ringing of the changes.

After-dinner speaking ranks, according to some authorities, among the fine arts, and it is a pity that an attempt at cultivation is not made by those who rise to their feet upon the least provocation. The great secret of public speaking is to know when and how to finish. The veriest numbskull possesses the ability to utter a few lame sentences, but his difficulty is to round them off and to sit down without a jerk. The fluent speaker is able to roll off platitudes and insincerities by the score, but even he flags towards the end, and with a half-muttered "I think that's all I have to say," sinks into obscurity once more, leaving an impression the reverse of favorable behind him. The man of real intelligence rattles out what first presents itself and may talk a heap of twaddle, but he has his peroration up his sleeve all the time, and delivers it with hammer-like effect just as his audience is at the last gasp. It may be an anecdote, a personal recollection, a witty rejoinder to a former speaker, a rub at the chairman—the whole point is that it hits its mark and produces a round of applause. A very good rule to follow is to inform the press beforehand that a copy of the speech will be given to them. The reporters gladly close their books and their ears, bored as they are with the incessant round of talking that is nightly their lot. The speaker is then free to talk just as he pleases, secure in the fact that what he will give to the press bears no necessary relation to that, but is merely a carefully prepared record of what he would have said had it been good form to read his manuscript.

The fact of the matter is that after-dinner speaking bids fair to become a public nuisance, if it has not already attained to that eminence. The drastic rule of the institution mentioned above might be imposed all round without conceivable loss, but anyway a time limit should be imposed, and the man who can't propose the health of a mayor or the mayor who can't say he's "very well thank you" in the course of a five minutes' speech should be silent for ever. The question of "good form" enters into the matter, too. No man would invite a friend to dine at a public restaurant, and entertain him with diatribes on sewage disposal or surface tarring. But the engineer, **qua** engineer, appears to be shameless. He will invite ladies to his society's dinner and surfeit them with speeches on the most uninteresting and unsociable subjects. A dinner, a conversazione, or a social evening is not an occasion for speechifying. Some amount of courtesy is due to the visitors, who can even dispense with the customary vote in their favor. The fact that they have been invited is a sufficient indication that their presence was desired, and no amount of effusive outpouring from the surcharged bosom of a bursting declamator can compensate them for the boredom that is inflicted upon them.

"Too Busy to Read"

HE is a familiar type—the fussy, fretful man who imagines that he is about the busiest fellow in town. He often dumps in the waste-basket, unwrapped, copies of business or technical magazines that contain valuable articles bearing directly on his problems. He fondly believes that he is too busy **practising** to bother with what others are **preaching.**

The trouble with this type of man is that he has not learned that the real executive is the man who so plans his work as to leave a reasonable amount of time for reading and planning.

There are shoals and breakers ahead when the accumulation of new ideas ceases.

The man who declares he has no time to read is unconsciously advertising his small calibre, his slavery to detail, his arrested development.—Printer's Ink.

Where the Laborer is Not Worthy of His Hire

WE wonder what kind of a sewage works manager they expect to get in England for the princely stipend of $8.75 a week! The job is advertised by the Hungerford Rural District Council in a recent issue of the "Surveyor." Applicants are required to furnish testimonials and to have had experience in the working of air compressors and ejectors. No attempt is made to conceal the figure at which the lucky "applicant" will be engaged. It is set forth in cold, convincing type—"Wages, 35s. per week."

The salaries offered technical men in the old country have been criticized in these columns before, but not for some years, and it is with some curiosity that we consult the advertisements of our contemporaries for late information.

We find the Cannock Urban District Council inviting applications from qualified persons for the appointment of Surveyor's Assistant—at a salary of ten dollars a week, the applicants "to be capable of making surveys, preparing plans and details and to have a thorough knowledge of the routine work of a municipal surveyor's department." Surely by way of a little pleasantry—not as an incentive to academical distinction—they add: "Preference will be given to candidates who hold the Certificate of the Institution of Municipal and County Engineers and who have had experience in setting out and measuring up important works."

One cannot help speculating as to what the younger generation of English municipal engineers do in their spare time. It is hardly to be wondered at that poker and other games of chance are not gaining ground in the old country.

Engineering Critics

IN literature and in art we have critics who are recognized for their ability to pick out inaccuracies and defects. These critics certainly are not the most beloved of persons, yet they are needed and do much to insure better literature and better art. Their adverse criticism is feared while their favorable criticism is much desired, and as a result writers and artists feel the necessity of putting forth their best efforts.

We now have a few public spirited engineers who are giving considerable attention to criticisms of some present tendencies in engineering practice. They realize, as do most of us, that adverse criticism, even though merited, is apt to be little appreciated by practicing engineers and that such criticism does not tend to increase their personal popularity. That these men have the courage to voice their convictions is to be commended. This kind of work requires true courage and unselfishness, and the only men who can accomplish much in it are those who are recognized as having a sound knowledge of engineering principles supplemented by long and practical experience. There is a tendency on the part of some engineers to feel that any adverse criticism of their work is a personal insult, as they do not seem to realize that their success or failure must be borne largely by the engineering profession.

In the past many engineers were loath to permit the publication of any part of their plans or any description of methods used by them. This was due to their desire to avoid publicity, to the feeling that their work was their personal property, or to the fear of adverse criticism of their designs. Engineers and contracting firms are just beginning to appreciate fully that such narrow views constitute a mistaken policy and often serve to retard their progress. We know of many successful firms who are entirely willing to make public intimate details of methods and systems used by them, and thus be judged by their work. On the other hand, the structural engineer for a building which recently failed during construction informed us that he had copyrighted the plans of this building and would prosecute anyone who published any part of them. Most engineers, however, will grant that they have little right to success unless they are willing to stand on the merits of their designs.

By the term "critic" we mean one who is skilled in judging of the merits of engineering work; and we believe there are too few of such men who are willing to give the engineering profession the benefit of their opinions. New engineering data are constantly being published and new formulas suggested, and it is to be regretted that such information does not bring forth more discussion from experienced engineers. The tendency is to accept experimental data and to make them the basis of engineering practice without careful analysis. A number of our present rules and so-called working formulas possess little merit. They may, perhaps, save a little time, but such a saving is usually made at the expense of efficient designing. We do not advise every engineer to voice his criticism of engineering practice and its problems, but competent, public spirited engineering critics are needed.—Engineering and Contracting.

Engineering Topics in the Old Land

Practice and Malpractice in the Field of Sanitation: Canadian and English Methods Compared — The Ramifications of Labor

Special London, Eng., Correspondence of the Contract Record and Engineering Review

IN the last issue of the Journal of the Royal Sanitary Institute there appeared an interesting article by Mr. F. J. Osborne Smith, of the Public Works Department, Ottawa. It dealt with drainage and sanitary fittings in Canada, and was accompanied by a reproduction of the diagrams supplied by the Ottawa Local Board of Health to licensed plumbers as explanatory of the by-laws regulating plumbing. The main difference between English and Canadian practice is the abolition (in the case of the latter) of gullies at the feet of waste pipes and the fixing inside the building of all pipes, both of these departures from "recognised" methods being necessitated by climatic conditions. Putting these conditions on one side, however, the abolition of the gullies, over which wastes must discharge in the open, is a distinct advantage. The average gulley forms a miniature cesspit, and Mr. Smith is right when he says "it behoves sanitarians to give this matter careful thought and attention with a view to removing these defects in the English system of house drainage." Curiously enough, in view of this opinion concerning "the foul and evil-smelling gullies in England," Mr. Smith retains in his system that much fouler and more evil-smelling contrivance known as a fresh-air inlet. "Provision must be made for it," he says, and he specifies that it shall be "connected near the trap, and taken outside and fixed as far as possible from any opening into the house, terminating at least 18-in. above ground, and left open or covered with a cap having an area of one-fourth more than that of the pipe. When left open," he adds, "it is usually fitted with a semi-circular bend, fixed vertically."

The Fresh-Air Inlet

There is nothing more pathetic in the history of sanitary science than the world-wide belief in the continuous upward flow of drain air. The system advocated by the scientists is simplicity itself. Connect a short pipe to one end of the drain and a long pipe to the other, and—"up she goes." Questions of temperature, humidity, air currents, friction, and all that sort of thing, simply do not enter into the calculation. The outside air rushes into the short pipe but never into the long, and conversely, the inside or foul air rushes out of the long pipe but never out of the short. And in its passage, this outside air carries with it the foul air that would otherwise accumulate in the pipes and force the traps. It having been proved to the satisfaction of the scientific mind that an inlet (being fixed at a lower level) cannot act as an outlet, various forms of valves—of mica, aluminium or other light substance—have been devised, to prevent the emission of foul air from this very fitting; and really (following up the argument) why should not another valve be fixed at the apex of the ventilating shaft to prevent the introduction of fresh air at that point? The ventilation system would then be doubly guarded, while a further guarantee would be afforded (to the scientific person) by the fact that as these valves never by any possibility act at all as they are intended to no harm could be done by their introduction. Mr. Smith does not appear to recommend the use of these valves, and it is surmisable therefore that he has had experience of them. It is no uncommon sight in London and other large English towns to see the street urchins playing around so-called fresh-air inlets—busily engaged in poking sticks and stones between the bars of the protective grating, while the drain air is olfactorily visible to the most casual passer-by. Among men of sterling commonsense ranks high the householder who in defiance of the local sanitary authority, **trapped** his fresh-air inlet.

Sewer Air

Among text-book writers the faculty of imitation is held in great esteem. What one writes another copies, and an error once set down in print is successively duplicated throughout all time. The obsession concerning the fresh-air inlet is a case in point, and another is afforded by the insistance with which, in spite of recent developments, the retention of the sewer-gas interceptor is urged. A Departmental Committee of the Local Government Board of England has said in so many words that sewer gas is for the greater part innocuous except for its smell; nay, that it has been found, bacteriologically—oh the magic of that word—and chemically to be purer ofttimes than the ordinary atmosphere. Such a statement is so startling that the writer feels compelled to quote from the Report of the Committee. "In sewers, whether old or new, ventilated or unventilated, in which sewage is moving and is not lying stagnant, the air differs but little from that of the atmosphere outside. . . . . If it (sewer air- possessed no smell, it would not do the least harm or cause ill-health. . . . . The number of microbes to be found in sewer air is usually less than the number to be found at about the same time in the atmosphere outside the sewer. . . . . The microbes collected from the fresh air were about three times as numerous as those collected from the sewer air. . .. . . Many of these investigators have arrived at the conclusion that microbes found in sewer air are derived not from the sewage at all, but from the air outside the sewer. . . . . It is in the case of bad sewers that the number of sewer air microbes would appear to be at a minimum." It would not be fair to say that the Committee officially and formally endorsed all these statements, but the following, from their "Summary & Conclusions," is startling enough in all conscience: "The entry of sewer air, into a house, is of correspondingly smaller importance, bacterially, than the entry of drain air."

Drain Air

The opinion in England as to the merits and demerits of the intercepting trap has, however, no concern with the matter under review, but it is noteworthy how little notice is taken of the solemn pronouncement of a Government Departmental Committee. Engineers are beginning to lose faith in expert committees, and especially in the medical expert committeeman. The fact is to be deplored, as guidance of some sort is necessary in these days of swift-changing opinion and the unceasing introduction of new appliances and methods. A more careful and more judicious (and less avuncular) selection of the members of Departmental Committees and Royal Commissions is desirable, if their recommendations and conclusions are to have any weight. While refreshing his memory on the Departmental Report the writer came across the following: "With few exceptions, the evidence before us was unanimous that the air-inlet is an objectionable feature of the house drainage system." If, as has been quoted above, drain air is worse than sewer air, it certainly is not only an objectionable but a highly dangerous feature of a drainage system. Writers of text books, however, still continue to plump for the old system, filching paragraphs from one another with an impartiality both admirable and amiable.

The Masterman

There has been much fluttering in building dovecotes anent the decision of the Theosophical Society to have their new building completed under direct trade union supervision. There is talk, too, of other contracts going in the same direction, the men being quite ready to return to work were they allowed to do so under their own conditions. The matter is one that would vitally affect every contractor—whether building or engineering—if it were practical politics. But it must surely be many years before trade unions can so organize as to be in a position to take the place of the contractor. Mr. E. Guy Dawber, one of the best known English architects, puts the case fairly when he says: "It is like attempting to navigate a ship without the assistance of the captain. Suppose the men's Federation succeed in getting rid of the master builder it will also mean that competition will be got rid of and there will be no safeguard for anybody who wishes to have a building erected; for there would be nothing to prevent the unions saying: "Now we have got a monopoly; our men's wages at present are one shilling per hour; we want one shilling and sixpence." Where would it all end? Then again trades unions, under the Trades Disputes Acts, are above the law, and could not be sued for damages if contracts were not properly carried out. While trades unions enjoy this privileged position, would they be supplied with material by builders' merchants? And if they did get materials, where is the money to come from? No money is advanced before the job is begun; it is only advanced at the rate of 80 per cent. on work done and fixed on the premises. If a building is begun and turns out a loss, who is to be responsible? The Union? Would they pay or would the client suffer? In the case of contractors they lose and whistle, but agreements could not be made with the unions, as they are above the law." Still, it behoves contractors in every part of the world to keep themselves posted in events which are moving now in so many surprising directions. The building of the Theosophists (and it is a big job, too) is to be carried out under direct supervision, and even although this is due largely to the peculiar influence and advanced opinions of Mrs. Besant, the principle is capable of extension. Too, several architects, tired of the eternal dispute between masters and men (and regardful only of their clients' interests) are contemplating the employment of direct labor (to be supplied by the Federation) with the consequent exclusion of the contractor. Labor (in England, at least) has the bit between its teeth.

There is now under construction in Victoria, B.C., a reinforced concrete trunk sewer about 2 miles in length which is to drain about 425 acres in a rapidly growing residential section of the city, as well as 1,000 acres in Esquimalt and 800 acres in Saanich. The sewer starts with a 27-in. diameter and increases to a 36-in. pipe at the outfall near Macaulay point, where tidal currents were deemed favorable for disposal without nuisance. For several hundred feet near the lower end of the sewer steel pipes were used, and were continued to a discharge below water level. The remainder of the line, however, consists of reinforced concrete pipe, cast in 5-ft. lengths. In laying the pipe there are required about 3,100 ft. of trench, largely in rock, and 7,250 ft. of tunnel, practically all in solid rock. The tunnel work is comprised in three separate bores ranging up to 65 ft. in depth below the natural surface, and known as tunnels, X, Y and Z. The first of these tunnels is now being driven with the aid of two shafts sunk from the surface above. This tunnel is 7 ft. high by 5 ft. wide, and is being advanced at the rate of about 5 ft. per day. About 135 men are now engaged on the work.

In view of the almost absolute cleanliness associated with porcelain and like surfaces, states the Railway News, a suggestion has been advanced that the present absorbent wood and iron-built carriages should be replaced by steel and porcelain construction, non-absorbent materials which will not carry germs and bacilli. Steel-frame coaches should be used, with panels of plate porcelain for floors, partitions, ceilings, etc., aero metal door and window frames, rust-proof steel laths for strength of the floors, and asbestos copper-coated tape for joints. The upholstering to be movable, so that it can be properly fumigated in the compartment. The use of porcelain is ideal, in that the whole train can be washed inside and outside. A steel frame and porcelain vehicle can be washed out easily once a week or when necessary with carbolic acid or any other disinfectant. Rules and regulations, maps, names of stations, notices, etc., may be burnt in under the glaze and the smooth hard surface impervious against mischievous alterations. Similar methods may also be utilized for station buildings, with porcelain panels glazed and decorated on both sides with the advertisements burnt in under the glaze.

Some Observations on the First Draft of the Town Planning Act

By R. O. Wynne-Roberts, Regina

Editor Contract Record and Engineering Review:

The Commission of Conservation through their committee on Town Planning Legislation are to be commended for submitting their draft Town Planning Act to the International Town Planning Convention held recently at Toronto, as it afforded the American delegates an opportunity of studying Canadian conditions and sentiments and at the same time gave the Canadian delegates a chance—limited though it was—of discussing this important matter before it was presented to the administrative governments of the provinces.

It was anticipated that Mr. Thos. Adams, of London, Eng., would lead off by discussing the draft measure, but instead he devoted most of the evening to a lecture on the principles of town planning. The information he imparted was excellent, but he refrained from making a single criticism of the draft act. In this, Mr. Adams was probably wise, for his limited acquaintance with Canadian conditions and requirements might easily have led him into technical difficulties; and even had he adopted safe grounds of argument, it might not have carried the same conviction as in the home land. Mr. Adams is a recognized authority on city planning and has studied the subject from many points of view in various countries. Nevertheless it is a matter of regret that he did not offer some observations as to the strength or weakness of the proposed Act as it appealed to him, for it must be admitted that dilating on the subject in an abstract manner, as he did, furnished no concrete reasons for amending the draft.

Dr. Hodgetts and his colleagues were somewhat apologetic in their references to the draft. They desired the delegates to understand that it was incomplete and in some ways inadequate. Dr. Hodgetts expressed a desire to see city planning carried out by authorities independently of the aldermen. This was animadverted upon by Hon. George Langley.

The draft bill contains fourteen sections, several sub-sections and two schedules. It provides for a Central Board, under the provincial departments of municipal affairs, consisting of a paid Town Planning Comptroller (chairman) and five others, who are heads of various other departments of provincial governments, although it is noticeable that the Deputy Minister of Municipal Affairs is not mentioned. Bearing in mind the undesirability of multiplying departments or boards with which the municipal authorities will have to work—each with its own specific requirements and each dealing with various phases of work—and that in some provinces the work may not be particularly onerous, it would appear to be reasonable to place this work in charge of the Local Government Boards where they have been created—for reasons that will be apparent later on.

It is also proposed to empower the municipal authorities to create local Housing and Town Planning Boards, consisting of the Mayor, Engineer, Medical Health Officer and two ratepayers, the latter preferably a financier and an architect. No further reference was made in the bill to the subject of housing. It is understood that it will be covered by another draft bill.

In the first place there is no limitation set as to the size of the village, town or city where this Board must be created. The term "municipal authority" covers every class and size, and therefore all are included. It is admitted that town planning is most desirable at the earliest stage of the growth of a village, for what is done then determines conditions for practically all time. It is apparent that such an Act would be a dead letter in a large number of places, because there are a much greater number of villages than towns and more towns than cities. It will be a dead letter because of the absence of men with the foresight and calibre required to perform the functions of their office and in the absence of any desire to formulate a scheme which will involve the expenditure of money. Villages are planned and laid out before there are many people living there. When a few do form a community, additional sub-divisions are often made without control; neither is there the desire to interfere on the part of the local people. The main hope is to see their village grow and nothing will be done which may in any way militate against such desired development. It is easy to conceive how land speculators can impress upon a few residents the importance of expansion. The draft bill may perhaps prove of service in towns and villages where the evils of excessive sub-division and inadequate provision for future local requirements are experienced and there is some measure of public opinion supporting the local board in making legitimate use of the powers conferred upon them. In small places it will be difficult to secure men wholly disinterested and willing to place their services at the disposal of their village. Architects of experience do not usually reside where

Mr. R. O. Wynne-Roberts.*

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*Mr. Wynne-Roberts, consulting engineer, Regina, has originated many important constructional schemes in Western Canada, among these being the project of the Regina Water Supply, which involved an outlay of $2,000,000. He has had extended experience in many parts of the world and as City Engineer of Capetown was in charge of a large water-works scheme which represented an outlay of $8.500,000. A sketch of Mr. Wynne-Roberts' career was published in the May 14, 1913, issue of the Contract Record and Engineering Review.

there is little work; neither do financiers locate where they do not find much scope for their business. Still, architects residing in small towns are naturally keen after business and if their clients are not imbued with great ideals the architects must, of course, abandon theirs. Financiers are often associated with the exploitation of lands for profit, and until they can see that town planning is an actual source of profit they will continue to follow the old ways. So that outside of the larger cities it is more than likely that a local board, constituted on the lines suggested will nullify the objects to be attained. It may be submitted that for towns having a population of less than, say, 10,000, the control of town planning might be reposed in the Central Board itself—that is to say, the municipal authorities of smaller towns would be guided by that board and not by a local board, which, owing to conditions inherent in many smaller towns and villages might become perfunctory and unsuccessful.

Moreover, it is proposed that each municipal authority shall create a separate local board to administer the Act. Such board will be non-elective and presumably, therefore, independent of public opinion and of the electors' vote. In the nature of our municipal constitution it is a question whether it is a good policy to establish such a system, for it tends to abolish popular control, which, in these days of democratic government—however defective it is—will bring about personal, interested and rancorous criticism—which is a condition worth avoiding. And, furthermore, it is desirable that popular government should be strengthened by persistent education and intelligent agitation, rather than cut into the ordinary prerogatives of authorities already established. It is worth noting that the men who are to constitute the local board are to consist of two officials whose tenure of office depends on the goodwill of municipal council: the mayor, who has annually to solicit the electors' support, and two ratepayers who are to be co-opted. It is improbable that any of these will take a determined stand to carry out any scheme, if it should meet with serious opposition. And if this should happen to be the case, in what superior position is the local board to the municipal council.

The local board shall have a permanent Housing and Town Planning Commissioner, which may be dismissed only by consent of the Central Board. This official will hold a unique position, for whilst his employers may be dismissed or ousted from office, he will remain. The remarks made as to the size of towns also apply here, for very small towns cannot afford to employ a Commissioner skilled in town planning, to attend to these duties only. Many towns do not employ engineers and some are without medical health officers, except in a nominal capacity. If it were possible to combine several towns into a district, a Commissioner might be employed without imposing a serious financial burden, and with greater security and efficiency.

Section 4 states that a town planning scheme may be prepared, which of course implies that it is optional, but Section 11 empowers the Central Board to order the preparation and submission of a scheme for approval, where the local board has failed to do so, and again in Sub-Section 3 of Section 2 the Central Board may apply for a mandamus to enforce compliance, and presumably carry out the work itself if the local board should stubbornly neglect its duty. Optional acts are often drafted with the best intentions, but are equally often non-operative because many interests come into play to thwart good movements. To ensure to the public the benefits of a general application of the act it should be obligatory in a manner similar to public health acts, otherwise one enlightened city will adopt the act and use the powers it confers and derive the advantages—if any—whilst others will ignore it until forced by one reason or another to do likewise. Meanwhile the evils it is proposed to remedy are somewhat aggravated.

The draft act provides for the preparation and approval of schemes within and without any municipality where land has already been built upon, or is likely to be used for that purpose, and once the schemes have been approved of they will have full force and effect and can only be varied or revoked by the approval of a subsequent scheme, of which due notice shall have been given to the public by advertisement. These powers appear to be adequate.

Further, the Central Board shall have powers to draft regulations to secure co-operation of the local board and the land owners. This is similar to the British Town Planning Act of 1909, but the conditions in Canada are dissimilar. In Great Britain the bulk of the land is owned by relatively a few persons, whereas in most parts of Canada land is owned by a multitude of small owners, many of whom do not live in the locality and only hold the land for incremental values. Any Canadian city may be selected and in and around it there will be found a large number of properties many of which are owned by non-residents, who are impressed only by possible appreciation in value. It will be difficult to arrange for co-operation in these cases—highly desirable though it may be. The writer thinks that the German enactments seem to be more adaptable for such a phase of town planning. The local authority under German laws decides on a scheme and if co-operation is secured, well and good, but in any case the scheme is put through, and each owner who has had his land re-subdivided receives an equivalent value of land. In many instances he gets land which is much more useful for building purposes. Town planning schemes, well thought out and arranged according to the need of the locality, will tend to improve the value of the properties affected. Whilst it may disturb the original subdivisions and some owners may be adversely affected, it is only by plenary powers that the desired consummation of town planning can be attained.

Anomalous Provisions

If in Sub-Section 5 it is intended that "the execution of any works" means sewers, water mains, street railways, etc., for those parts included in the scheme, then there will be dual authorities attending to such duties. It is contended that the local board should not actually carry out any work further than laying out of the street lines and making provision for the requirements of the district under consideration, otherwise there would be abundant source of friction between the local board and the municipal authority. Sub-Section 7b of Section 5, however, states that the local board shall prepare plans of the territory, showing tentative schemes for facilitating the development of permanent improvements in sanitation, transportation, conservation and beautification of the municipality, and that it shall carry into effect as opportunity arises such portions of the improvements as its financial resources will permit. There is therefore not much left for the existing municipal council to attend to, except routine administration and to find the money, and also to meet opposition and criticism on behalf of the local board which they created. Such a situation can scarcely be satisfactory to either body.

A perusal of Schedule A will again suggest that the local board will supplant the municipal council in the execution of public works as far as they relate to town planning. If all the works mentioned in this schedule were carried out by the local board, then it would be necessary to employ the City Engineer and other officials or to employ a separate staff. In all cities, except the large ones, a separate staff would be out of the question. So that the same officials would attend to local board and municipal council, with the anomaly that in the former the city engineer would be a member of the board and in the latter an official of the council. Further, as the local board will always be at least three-fifths municipal council men, why constitute a separate board at all? If a separate board is necessary, it should have a direct and independent mandate from the ratepayers, similar to School Boards, etc.

Administration of Funds

With regard to funds, it is to be noted that the local board in the absence of special provision in any town planning scheme, must not assess property without the authority of the municipal council. Nor can money be borrowed or any bonds be issued without such consent and the approval of the Central Board. In Saskatchewan it will also require the sanction of the Local Government Board. The municipal council, therefore, can veto any scheme by refusing to furnish supplies until the local board has statutory powers to levy rates. Reference has already been made to the question of placing this work under the control of the Local Government Board already or hereafter to be created. One reason for this is the fact that municipal loans come under their purview and if this Town Planning Bill is adopted then the authority of the Central Board to approve loans is redundant. The Local Government Board should have no other body to interfere with its operation, for it is conceivable that a Central Board might approve of a scheme and authorize a local board to borrow, whereas the Local Government Board, on whom the final decision would rest, might, in their fuller knowledge of the local circumstances and the state of the money market, refuse to sanction the issue of bonds. Where no Local Government Board is in existence then the Central Board might be free to operate.

The preliminary expenses in preparing any scheme are to be paid out of current revenue or by a special tax to be levied by the municipal council. This is limited to one-fiftieth of one per cent of assessed value of cities under two hundred thousand inhabitants and one-hundredth of one per cent in cases of cities of two hundred thousand and over. It is not clear whether the assessed value is meant to be the net or the gross. Most cities have many properties which are exempt from taxation, but we will assume that it is on the net assessment. In a town where the assessment is one million dollars the expenses will be limited to two hundred dollars, which is insufficient to pay the salary of the Commissioner—let alone make any special investigation. Montreal has an assessed valuation of about $791,000,000. Assuming this is net, then the Montreal local board could spend $79,100. On a similar basis Toronto could spend $51,600, Ottawa $26,000, Guelph, $2,140, Regina, $14,600. It will be interesting to know whether the complete town planning scheme of Ottawa has cost less than $26,000 and of Berlin (Ont.) less than $1,900 and left a surplus ample to pay an adequate salary to the Town Planning Commissioner. The point to be made here is that the development of any town planning scheme is as much a capital charge as the cost of preparing the preliminary plans of water, sewerage, or street railway schemes, or the legal and other expenses in promoting railway or canal schemes, and should be included in the cost. When it has to be paid out of revenue funds then the present ratepayers pay for posterity. The cost of routine administrative work should be paid out of revenue.

With regard to the section dealing with the increased value of property due to the execution of any town planning schemes, which proposes to impose a double tax on the increased valuation of properties improved over ten per cent, and to hand one-half of such extra-taxation to the local board, it is essential to remember that pavements, sewers, and water mains will alone add to the value of property. How is the authority to differentiate between incremental values due to these works and those due to ordinary town planning itself? Moreover, if the municipal authority spends a large sum of money on pavements, sewers, etc., it should derive the benefit of the increased valuation—although it must be borne in mind that the owners have to bear the bulk of the cost as improvement rates. If, however, the local board itself carries out such works the situation may become still more complicated. Assume that a radial or diagonal thoroughfare is laid through a district. It will no doubt improve the value of properties within a considerable range, but the assessor will have some difficulty in placing a differential value and in fixing the limits of the influence of the improvement scheme. It will not be limited to the immediate properties but will be felt for a considerable distance from such radial street. In some cities, increments occur without any appreciable reason. In other cases it will require time to prove the value of any town planning scheme, and therefore some limitations might be fixed as to the period in which increased assessments may occur. Furthermore, in some instances it may need only to change the assessor to obtain a higher assessment. It is evident that some complication will result from dual authorities empowered to carry out works which are intimately related.

Province of Local Board

The local board, according to Section 6 (b) is to be empowered to "carry out any work which it is the duty of any person to execute under the scheme, in any case where it appears that delay would prejudice the efficient operation of the scheme." It will be interesting to know what this means. Supposing a street were to be widened or changed in direction so that a slice or corner of a building had to be cut off. Would it be compulsory on the owner to execute the work? To obtain compensation he must lodge a claim in not less than three months after the publication of the Central Board approval, and if the terms cannot be agreed upon then the matter is to be settled by arbitration or by some other method to be mutually agreed upon.

The local board may find it difficult to finance this scheme, because the acquisition of property after demolition or alteration has often brought about somewhat erratic results. The writer remembers an instance where land measuring about 150 ft. by 20 ft. was required to be taken from the front portion of a churchyard for the purpose of widening an important street. The Council anticipated that the value would be about

$25,000 and as the improvement was urgently needed the amount to be paid was referred to arbitration. The arbitrators awarded $150,000. Take another case. The Metropolitan Water Board, of Boston, who constructed the Massachusetts Dam, employed an appraiser to value the land required for this reservoir. A generous valuation of $697,000 is reputed to have been placed on this land, but the actual cost was $1,182,000 (Report of Special Committee of American Society of Engineers, 1913). Other instances could be quoted, but the above will suffice to show how Boards can be financially embarrassed by unexpected results and thus jeopardize the schemes and afford an abundant crop of criticism.

By all means acquire property, widen streets, construct boulevards and do all that is necessary to improve the town, but it is wise to ascertain the cost first of all. Approval of a scheme will doubtless depend in most cases on the estimated ultimate expenditure of money. Consequential damages are difficult to anticipate.

The writer submits that the ultimate success of any town planning authority will be established more securely and satisfactorily if it be made a part of the municipal council, but always as a separate committee, similar to a Watch Committee, Library Committee, etc., provided that the Central Board be composed of men of experience, tact and energy, possessing the confidence of the public, and therefore removed as far as possible from politics.

In conclusion, the writer desires to express the hope that the good intentions which impelled the Commission of Conservation to draft a measure will continue to prevail. Town planning legislation is needed soon, but it must be effective, adequate and sufficiently elastic to meet various conditions.

The time for actual discussion of the draft act at the Convention was limited and the writer had no opportunity of presenting his views. In the interim he has had more time to digest the proposals, and, feeling that the subject is of sufficient importance, he has written the foregoing observations for the consideration of those whom the subject may concern and interest.

Even if the draft act is immature and inadequate it will do some good in giving many an occasion to think. Whilst some of the observations may appear to be stringent there was no desire to do anything more than present the case impersonally and as definitely as possible.

Town planning is no new study to the writer, as he has written, read and discussed the matter in various phases for the last ten years and has visited many of the places where town planning has been carried out.

R. O. Wynne-Roberts.

Regina, June 24, 1914.

Cost of Constructing and Operating Slow and Rapid Sand Water Filtration Plants

IN a very extensive paper before the recent annual convention of the American Water Works Association Mr. George A. Johnson of New York City discussed present day water filtration practice from all points of view. We here republish from Engineering and Contracting the portion of his paper bearing on the relative cost of slow and rapid sand filtration. Following the excerpt from Mr. Johnson's paper we publish a discussion of the same subject by Mr. John H. Gregory of New York City, which was delivered before the same convention. Mr. Johnson's statement as to cost follows:

Relative Cost of Slow Sand and Rapid Sand Filtration

Construction.—In discussing the cost of building water filtration works of the slow sand and rapid sand types, respectively, consideration will be given only to those items referring to the filter plant proper. Cost of land, pumping machinery, outside connecting piping, intakes, etc., in fact everything outside the filtration plant proper, will not be considered.

For slow sand filter costs the items will include the necessary filter buildings and filters with all appurtenances, all inside piping, sand handling apparatus, preliminary sedimentation basins, preliminary filters and appurtenances and clear water reservoirs.

For rapid sand filter costs the items will include the filter buildings and filters with all appurtenances, all inside piping, filter washing apparatus, coagulating and clear water basins. Thus a fairly good idea may be had of the relative cost of building purification plants of the two types.

It is true that, on account of the much greater area required, the cost for land is far greater in the case of slow sand filtration systems than for rapid sand systems. Roughly, other things being equal, land will cost 20 times as much for a slow sand filter installation as for a rapid sand plant. Furthermore, in large projects, it is often difficult conveniently to locate a site for slow sand filters, while for a rapid sand filter plant it is a relatively easy matter as a rule. If it is necessary to go a long distance in locating an extensive and suitable area of land for a slow sand filter site there is incurred a large expense for a conduit to bring the filtered water to the city. This is very rarely necessary in the case of rapid sand filter projects. So that, in studying the comparative figures which follow, it must distinctly be borne in mind that the costs given for slow sand filter installations are really low, since the important considerations just mentioned are not charged against them.

The figures given in Table I show that the approximate relative cost of building the slow sand and rapid sand filter plants mentioned was $32,600 and $12,100, respectively, per 1,000,000 gals. daily capacity. At 5 per cent the fixed charges on these sums would amount to $4.47 and $1.66, respectively, per 1,000,000 gals. of water filtered.

Operation and Maintenance.—The cost of operation and maintenance of filtration plants in a large measure varies, of course, with the quality of the raw water. In a general way the following examples will serve to show the charges ordinarily made against the operation and maintenance of representative water filter plants in this country.

To summarize, the average cost of building seven of the largest and most modern slow sand filter plants was $32,600 per 1,000,000 gals. daily capacity; and, likewise, the average cost of building six of the largest, and two medium size, rapid sand filtration plants was $12,100 per 1,000,000 gals. daily capacity. The average cost of operation and maintenance varied widely, of course, but averaged $2.86 and $4.04 per 1,000,000 gals. of water filtered by the slow sand and rapid sand systems, respectively. Adding these last figures to the fixed charge on the first cost of construction makes up the following totals:

	Per 1,000,000 gals.
Slow sand filtration	$7.33
Rapid sand filtration	5.70

Discussion by John H. Gregory

Mr. Gregory's discussion of the paper prepared by Mr. Johnson is here given in full:

The author has presented a paper which contains much of interest to water works engineers and superintendents interested in filtration, and there is much in the paper with which the speaker is in hearty accord. There are, however, some phases of the subject on which the speaker holds somewhat different views from those of the author, among which may be mentioned the questions of the cost and difficulty of securing sites for slow sand filters and those of the cost of both slow and rapid sand filters.

Selection and Cost of Site.—The author states: "It is true, on account of the much greater area required, the cost for land is far greater in the case of slow sand filtration systems than for rapid sand systems. Roughly, other things being equal, land will cost 20 times as much for a slow sand filter installation as for a rapid sand plant." There is but little question that, under ordinary conditions, the cost of land for slow sand filters will exceed that for rapid sand filters, owing to the larger area required, but that it will amount to as much as "20 times" that for slow sand filters is open to question. Those who have had experience in acquiring land for water works projects know that, even if only a small piece of land is required on which to locate the works but that this piece of land is a portion of a much larger tract, the purchaser might often as well buy the whole tract of land as to buy only a small portion of it. Thus it may readily be that, in acquiring a site for rapid sand filters, much more land would be actually purchased than needed simply for the plant. It may be that the area required for the construction of a slow sand filter plant will be 20 times that required for a rapid sand filter plant but that the land will cost 20 times as much does not necessarily follow.

In discussing further the question of site the author states: "Furthermore, in large projects, it is often difficult conveniently to locate a site for slow sand filters, while for a rapid sand filter plant it is a relatively easy matter as a rule. If it is necessary to go a long distance in locating an extensive and suitable area of land for a slow sand filter site there is incurred a large expense for a conduit to bring the filtered water to the city." The inference might be drawn from this that it has been exceedingly difficult to secure sites for large slow sand filter plants but the history of many of the plants which have been built will hardly bear out this inference.

In commenting on some of the plants which the author mentions in Table I the speaker might say that he has been personally connected with 7 out of the 15 plants mentioned and is familiar with the reasons which led to the selections of the sites on which these works were built. It is, of course, necessary to have land on which to build filters, whether of the slow or rapid sand type, but in the selection of a site local conditions are often a very important factor.

Table I.—Cost of Construction of Slow Sand and Rapid Sand Water Filtration Plants.

City.	Kind of filters.	Present daily filtering capacity, gals.	Approximate cost per 1,000,000 gals. daily capacity.
Albany, N. Y.	Slow sand	20,000,000	$20,000*
Pittsburgh, Pa.	Slow sand	200,000,000	26,000*
Philadelphia, Pa.:			
Torresdale	Slow sand	250,000,000	37,700*
Upper Roxborough	Slow sand	28,000,000	29,800
Lower Roxborough	Slow sand	17,000,000	26,300*
Belmont	Slow sand	60,000,000	45,200*
Washington, D. C.	Slow sand	100,000,000	30,000†
Cincinnati, Ohio	Rapid sand	112,000,000	11,400‡
Columbus, Ohio	Rapid sand	30,000,000	13,000§
Dallas, Texas	Rapid sand	15,000,000	13,000
Harrisburg, Pa.	Rapid sand	16,000,000	10,300
Little Falls, N. J.	Rapid sand	32,000,000	15,000
Lorain, Ohio	Rapid sand	6,000,000	14,000
New Milford, N. J.	Rapid sand	24,000,000	11,000
Watertown, N. Y.	Rapid sand	8,000,000	11,250
Weighted averages	Slow sand	....	$32,600
	Rapid sand	....	12,100

*Cost of preliminary filters included. †Cost of Dalecarlia Reservoir not included. Cost of McMillan Park Reservoir included, and also cost of remodeling Georgetown Reservoir, as well as cost of coagulating basin. ‡Cost of large plain sedimentation basin not included. §Cost of softening works not included.

At Albany, N.Y., for example, practically the first ground available on which filters of either type could be built and which could be purchased at a reasonable price, was that on which the slow sand filters were actually built, just north of the city line. It happened that there was another tract of land a little nearer to the existing water works pumping station, to which the filtered water was to be delivered, where it would have been possible to build either slow or rapid sand filters. To have acquired land there, however, for either type of filters, would have been very expensive. The site on which the filters were built had another advantage in that the intake there would be further away from local sources of pollution. At Albany the Hudson River is tidal. The sewage from the city was and still is discharged into the river without treatment and on flood tides there is often an upstream current which carries some sewage with it. It will be seen then that other factors than simply area of land alone may have a bearing.

At Pittsburgh, Pa., as far as the speaker is aware, no difficulty was found in securing a site for the slow sand filters there, which plant is one of the largest in the world. The filter plant is located directly across the Allegheny River from the Brilliant Pumping Station, from which most of the water used in the city is pumped. It is true that it was necessary to build conduits under the river to bring the filtered water to the pumping station, but the case would have been the same if rapid filters had been built instead, for, if the speaker's memory is correct, the best site on which filters of either type could have been built was that on which the slow sand filters were constructed.

For the four slow sand filter plants in Philadelphia mentioned by the author, namely, Torresdale, Upper Roxborough, Lower Roxborough and Belmont, and of which the speaker had charge of the design, no trouble was experienced in securing suitable sites.

As regards the Lower and Upper Roxborough filter plants, local conditions were of the greatest importance in that it was necessary to utilize existing reservoirs as settling basins, as well as existing pumping stations and pipe lines. Somewhat similar conditions existed with reference to the Belmont plant, although in this

Table II.—Cost of Operation and Maintenance of Slow Sand and Rapid Sand Filtration Plants.

Year.	City.	Kind of filters.	Average volume of water filtered daily. Gals.	Cost of operation and maintenance per 1,000,000 gals. of water filtered.
1911	Albany, N. Y.	Slow sand	20,000,000	$2.50
1912	Pittsburgh, Pa.	Slow sand	100,000,000	3.41
1911	Philadelphia, Pa.	Slow sand*	9,000,000	5.62
1911	Philadelphia, Pa.	Slow sand†	13,000,000	3.59
1911	Philadelphia, Pa.	Slow sand‡	38,000,000	3.88
1911	Philadelphia, Pa.	Slow sand§	202,000,000	1.91
1912	Washington, D. C.	Slow sand	62,000,000	4.01
1912	Cincinnati, Ohio	Rapid sand	50,000,000	4.12
1911	Harrisburg, Pa.	Rapid sand	9,000,000	8.93
1912	Little Falls, N. J.	Rapid sand	30,000,000	3.20
1912	Louisville, Ky.	Rapid sand	25,000,000	3.48
1912	New Orleans, La.	Rapid sand	16,000,000	5.32
Weighted average		Slow sand	....	$2.86
		Rapid sand	....	4.04

*Lower Roxborough; †Upper Roxborough; ‡Belmont; §Torresdale.

case there was no reservoir which could be utilized as a settling basin.

The Torresdale slow sand filter plant is the largest single plant in the world, and if difficulty had been experienced in securing suitable sites for such works it would naturally be expected to have occurred here. Such was not the case, however, and the plant was built inside the city limits. It is true that the plant was located some distance upstream from the closely built-up part of the city, and that a conduit about 2½ miles in length was constructed through which filtered water is delivered to the Lardner's Point pumping station, but it was good judgment on the part of the city authorities to locate the works where they did.

The Delaware River at Philadelphia is tidal and is polluted by the discharge of sewage from the city, and it was to avoid pollution as well as to secure a site that the plant was built as far upstream as it was. It might be added further that the city has already constructed a small sewage disposal works just below the Torresdale filter plant (the Pennypack Creek works), where sewage is treated and the effluent disinfected before discharge into the river, in order to guard against raw sewage from the nearest point from reaching the intake of the Torresdale filters. Had rapid sand instead of slow sand filters been built at Torresdale there is no question in the speaker's mind but that such a plant would have been built as far upstream as were the slow sand filters.

One might fancy, possibly, that trouble would be experienced by the city of New York in securing sites for filters. Such is not the case. Over ten years ago the Commission on Additional Water Supply, in its investigations for an additional water supply for New York City, looked into the question of filter sites not only for the additional supply but also for the Croton supply. Sites were found where slow sand filters could be built in close proximity to the existing Croton Aqueduct, and sites for slow sand filters were also found and surveyed where the additional supply could be filtered along the line of the proposed new aqueduct. Some years later the Department of Water Supply actually prepared detailed plans for a slow sand filter plant for the Croton supply, on a site located in New York City, namely, in the east basin of Jerome Park Reservoir, the construction of which was suspended pending a decision as to the filtering of the supply. In the case of New York City it is not a question of going a long distance and building an expensive conduit to get a filter site, but rather a question of going a long distance and building an expensive conduit to get water.

The Cincinnati Plant

At Cincinnati, Ohio, the rapid sand filter plant, which is the largest of its kind in operation in the world, was built well upstream above the city where plenty of land was available for either rapid or slow sand filters. The filtered water is discharged through a long conduit to the main pumping station from which it is pumped to the reservoirs in Eden Park. This plant was built for the future as well as for the present and it was good judgment to locate the plant as far upstream as it was.

At Columbus, Ohio, the rapid sand filters were built at some little distance upstream above the city. It was a case here of going upstream to get out of the flood zone, although sufficient land for either rapid or slow sand filters was available nearer the city. At the point where the plant was finally built there was sufficient land for either rapid or slow sand filters. In acquiring the land for this particular plant it was found that it would be about as cheap to acquire the whole tract of land on which the works were built as to acquire only so much of the same as would be needed for the plant alone.

Perhaps enough has been said to point out that factors other than the area of land alone have to be taken into account, not only for slow but for rapid sand filters as well, in selecting a suitable site.

Cost of Construction.—The author also considers, in Table I, the cost of construction of different types of filters. It is exceedingly difficult to compare satisfactorily the costs of construction of different plants, even where the fullest information regarding the same is available. Those who are not well posted as to the history of some of the plants cited in the table may possibly be misled as to the cost of building both slow and rapid sand filters if they accept the figures of the author without full knowledge of local conditions.

One of the features which very materially affects the cost of such works is the total reservoir capacity provided, that is, the combined capacity of the settling basins are of the clear water reservoirs. To illustrate: The rapid sand filter plant at Little Falls, N.J., which, in the author's table is the most expensive one cited, and which cost $15,000 per 1,000,000 gal. daily capacity, has a coagulating basin capacity of 1.3 hours and a filtered water reservoir capacity of 2.6 hours, or 3.9 hours total reservoir capacity. At Columbus, Ohio, the rapid sand filter plant there, which the author states cost $13,000 per 1,000,000 gals. daily capacity, the next to the highest in cost cited, has a settling basin capacity of 12 hours and a filtered water reservoir capacity of 8 hours, making a total reservoir capacity of 20 hours, or five times as much reservoir capacity as that of the Little Falls plant. If the reservoir capacity of the Little Falls plant had been approximately that of the Columbus plant the cost of construction of the Little Falls plant would have been materially increased over that given by the author. Again, the New Orleans rapid sand filter plant might be cited, which has 35.2 hours total reservoir capacity, or practically nine times as much reservoir capacity as that of the Little Falls. Other factors which affect the cost of construction are the character of the raw water, the rate of filtration, the character of the construction of the works, etc.

In his reference to the Albany slow sand filter plant the author gives its capacity as 20,000,000 gals. daily. The Albany plant as originally built before the pre-filters were added had a capacity of 15,000,000 gals. daily. The addition of the pre-filters increased the capacity of the plant very materially so that at the present time the capacity is probably in the neighborhood of 28,000,000 gals. daily. If the capacity is taken at 28,000,000 instead of 20,000,000 gals. daily the cost of the plant would be about $14,300 instead of $20,000 per 1,000,000 gals. daily capacity as given by the author.

The Philadelphia slow sand filter plants were expensive plants to build. They differ in one way from many of the other filters of the same type that have been built in that underneath the filter floors and carried up all around the side of the filter is a layer of puddle. This item alone materially increased the cost of construction.

In the cost of the Lower Roxborough plant the author did not include the cost of the Lower Roxborough Reservoir which was built many years before, and which supplies settled water to the filter plant. Again, a similar condition exists at the Upper Roxborough filter plant with regard to the settling basin. The New Roxborough Reservoir was built some ten years earlier than the filter plant, and the author has not included its cost in the cost of the filter plant. Strictly speaking, the costs of the reservoir should be included in the costs of these two plants so that the figures would be comparable with the costs of the other slow sand filters cited.

The Philadelphia plants were built during a period of very high prices, and to use the costs of construction of these plants to indicate the reasonable cost of slow sand filters may be very misleading except to those who are familiar with the early history of these works and who are aware that the costs were high and that the plants could be duplicated at less cost.

Montreal and Toronto Plants

The largest slow sand filter plant under construction in America at the present time is at Montreal, and, when completed next year, will have a capacity of 60,000,000 U. S. gals. daily capacity. The total cost of the plant, on the basis of the lump sum contract prices, including the low lift pumping station, will be about $22,600 per 1,000,000 gals. daily capacity. Deducting the low lift pumping station the cost will probably be about $21,000 per 1,000,000 gals. daily capacity.

It would have been interesting if the author had cited the cost of the slow sand filter plant which was completed at Toronto about two years ago. This plant has a capacity of 48,000,000 U. S. gals. daily, assuming one-sixth of the filter area to be held in reserve, and based on a rate of filtration of 6,000,000 U. S. gals. per acre daily, the rate for which the plant was designed. The cost of the plant, omitting the low lift pumping station, was only about $12,700 per 1,000,000 gals. daily capacity.

In considering the weighted average cost of slow sand filters given by the author, namely, $32,600 per 1,000,000 gals. daily capacity, it may be well to bear in mind that the Montreal plant will cost only about $21,000, that the Albany plant cost about $14,300, and the Toronto plant only $12,700 per 1,000,000 gals. daily capacity.

In referring to the cost of rapid sand filter plants the author cites the Columbus plant as costing $13,000 per 1,000,000 gals. daily capacity. This plant was designed and built under the speaker's direction and is a water-softening as well as a rapid sand filter plant. The speaker is not informed as to what items the author included in arriving at the cost of the Columbus plant, but in the speaker's judgment the Columbus plant, considered as a rapid sand filter plant alone, cost nearer $15,000 than $13,000 per 1,000,000 gals. daily capacity, the figure given by the author.

Another rapid sand filter plant which the author might have cited is that at Toledo, Ohio. Part of the plant was built for a capacity of 60,000,000 gals. daily, although the present capacity of the works is considerably less. Including only such items as are chargeable to the filter plant proper the works cost about $14,500 per 1,000,000 gals. daily capacity.

Another rapid sand filter plant which might have been cited is that at Grand Rapids, Mich. The plant was completed inside of the last two years and has a capacity of 20,000,000 gals. daily. The cost of the plant, as given to the speaker by the Grand Rapids officials last year, including such items as are chargeable to the filter plant proper, was $16,300 per 1,000,000 gals. daily capacity.

In December, 1912, the city of New York received bids for a rapid sand filter plant to be located at Jerome Park Reservoir and having a capacity of 320,000,000 gals. daily. The speaker is more or less familiar with the plans for the proposed Jerome Park filters as he served as one of a Commission of Engineers appointed by the Board of Estimate of New York to report on the same. Taking the lowest bid received and adding to it the cost of the buildings and other necessary work, the Jerome Park filter plant, which would have been the largest rapid sand filter plant in the world, would have cost about $18,400 per 1,000,000 gals. daily capacity. When the plant is built, and it is greatly to be hoped it will be built soon, the actual cost will probably be in the neighborhood of $20,000 per 1,000,000 gals. daily capacity, as much of the excavation for the plant has already been completed.

The author gives the cost of the Cincinnati rapid sand filter plant, which has a daily capacity of 112,000,000 gals., as $11,400 per 1,000,000 gals. daily capacity, and states that the cost of the large, plain sedimentation basins is not included. At Cincinnati there are two large settling basins to which the raw water from the Ohio River is pumped. The water is first settled in these two basins at the filter plant. There is no question in the speaker's mind but that the settling basins are part of the filter plant at Cincinnati, but just how much of the cost of the same should be chargeable to the filter plant may be a question. Mr. J. W. Ellms, the superintendent in charge of the filters at Cincinnati, in a paper printed in the Journal of the Association of Engineering Societies in January, 1912, states:

The settling reservoirs, which have a capacity of 330,000,000 gals. of available water, are in part a portion of the water purification plant, although they also serve the purpose of storage basins and were designed for such a use quite as much as they were for sedimentation purposes.

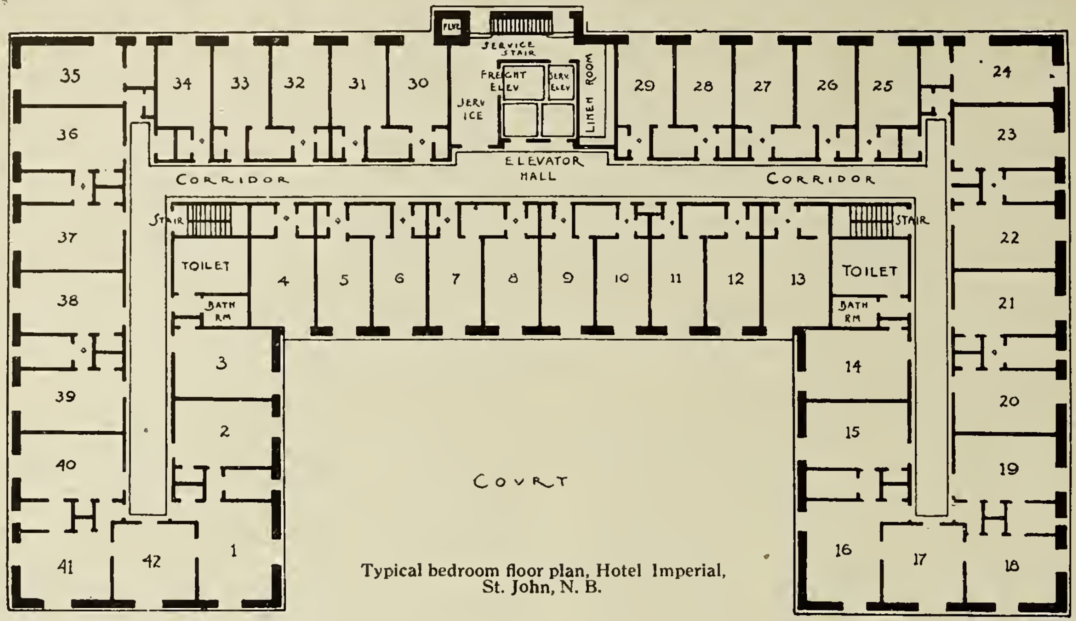
The two settling basins cost $1,521,000, or about $13,600 per 1,000,000 gals. daily capacity of filter plant. Adding this cost to that of the filter plant would give a total cost of $25,000 per 1,000,000 gals. daily capacity. As the settling basins serve as storage reservoirs also it may be reasonable to charge the filter plant with perhaps only half their cost. On this assumption the cost of the settling reservoirs chargeable to the filter plant would be $6,800 per 1,000,000 gals. daily capacity, thus making the total cost of the filter plant $18,200 per 1,000,000 gals. daily capacity.

The New Orleans Plant

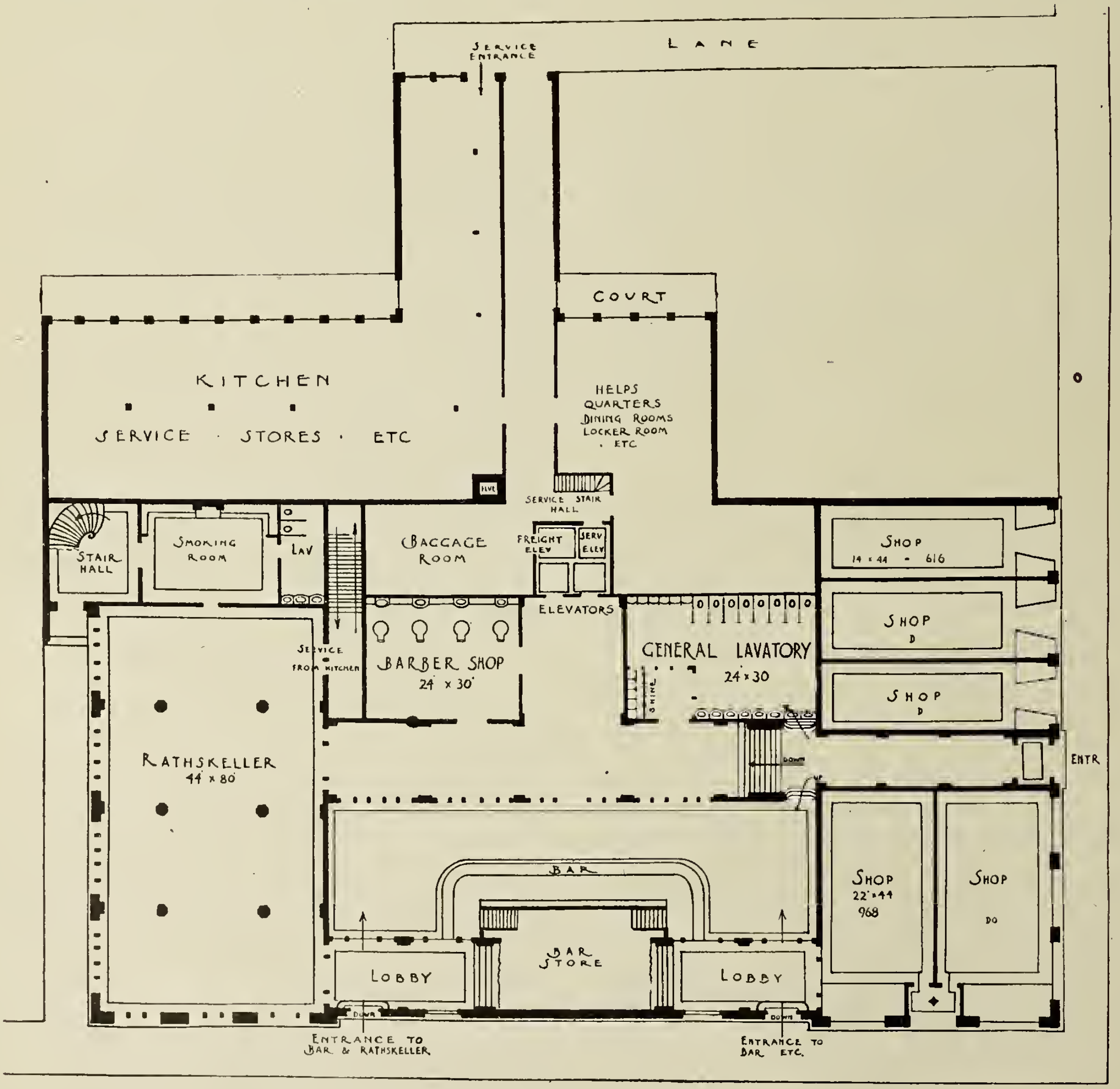
Still another plant which the author might have cited, and among the best in the country, is that at New Orleans, which has a capacity of 40,000,000 gals. daily. Including only such items as are chargeable to the filter plant proper the cost of the New Orleans plant was about $30,200 per 1,000,000 gals. daily capacity.

The weighted average cost of the Columbus, Toledo, Grand Rapids, Cincinnati and New Orleans rapid sand filter plants is $18,600 per 1,000,000 gals. daily capacity, while the author gives a weighted average cost for rapid sand filters at $12,100. In other words, the weighted average cost of the five plants just cited, all of which are in operation and which are among the best in the country, is over 50 per cent higher than the weighted average cost given by the author.

The speaker has but little further to say on the subject of costs except that, in his judgment, the weighted average costs as given by the author are too high for slow sand filters and are too low for rapid sand filters.



Typical bedroom floor plan, Hotel Imperial, St. John, N. B.



Ground floor plan, Hotel Imperial, St. John, N. B.

Similarly the fixed charges on the costs of construction would respectively be too high for slow sand and too low for rapid sand filters.

The speaker is not presenting any brief for slow sand filters. The rapid sand filter is more flexible than the slow sand filter and in the majority of cases in the United States is better adapted to the purification of water than is the slow sand filter. The slow sand filter has done and is still doing good work in this country, and the present status of water purification is, to a large extent, due to the introduction of the slow sand filter.

Splendid New Hotel Planned for St. John, N. B.

Messrs. Ross and Macdonald, of Montreal, have drawn plans for a proposed hotel at St. John, N.B., to be known as the Hotel Imperial, for the Hotel Company of St. John, Limited. The building will be erected on the north corner of King Square and Sydney Street, with a frontage of 184 feet on King Square. It will be six storeys high, the plans providing accommodation for 200 rooms, 125 of which will have private baths. The plans also provide for a large public dining room, private dining room, restaurant, banquet and dancing hall, large rotunda, writing rooms, ladies' parlors, tea room, bar room, gentlemen's cafe adjoining, and barber shop. The restaurant will have a seating capacity of about 300. The plans have been so drawn as to allow shops on the ground floor facing on King Square and others facing on Sydney Street. The building will be absolutely fireproof. The equipment includes a cold storage plant for the kitchen and bar.

Proposed Hotel Imperial, St. John, N. B.

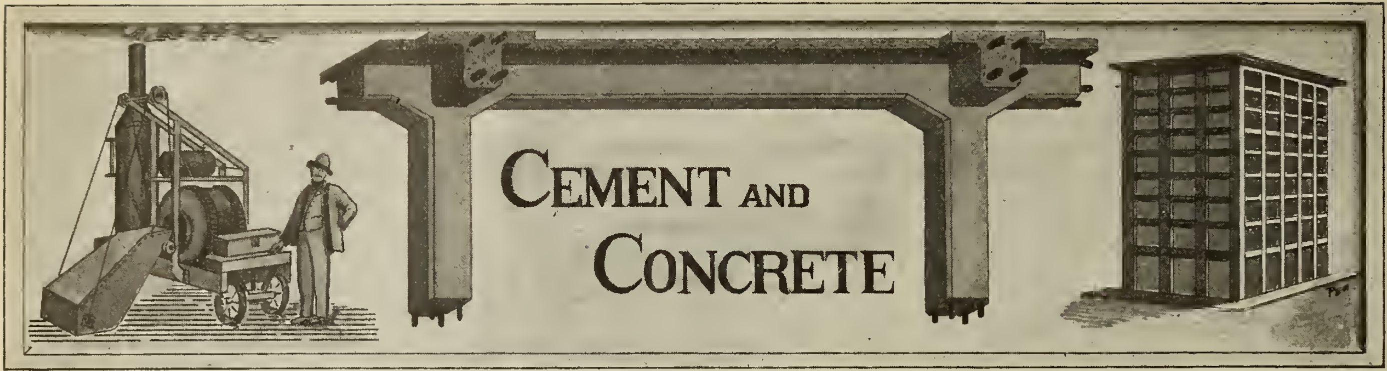
Including land and interest charges, the building is estimated to cost $760,000, while the furnishings will involve an expenditure of an additional $125,000. The frame of the building will be of steel, with reinforced concrete floors. The exterior is to be of Indiana limestone and clay brick, with a roof of copper. Several elevators will be installed.

Across the border, the use of hollow tile as a structural building material has been given a great impetus by the recognition by the United States Government of this type of construction. Notable instances of this fact may be found in the new Post Office building to be erected at Grass Valley, California, and in a new dormitory building to be erected for the Phoenix Industrial school for Indians at Phoenix, Arizona. In both of these cases, hollow tile are specified for the construction of exterior load bearing walls.

Extensive Buildings for the Canadian Kodak Company, Limited, Toronto

Excavation is in progress on the site for the erection of an extensive range of buildings for the Canadian Kodak Company, Limited, Toronto. The new plant will consist of seven buildings with a floor area of more than 480,000 square feet. The largest building will be 460 feet long by 80 feet wide, and five storeys high. When completed the plant will be one of the largest manufacturing establishments in Canada. It will be located at Mount Dennis, an imposing site situated about a mile beyond the city limits and will involve an outlay of about $1,250,000. It is anticipated that the new plant will be ready for occupation in about two years. On completion it is the intention of the company to transfer the entire industry at present located in three buildings on King Street west, to the new plant. The plans call for reinforced concrete construction, with metal sashes glazed with wire glass. Some idea of the size of the structure will be gathered from the fact that 2,500 tons of steel bars, 600 tons of fabricated structural steel, 80,000 square feet of metal sash and 25,000 cu. yds. of concrete involving the consumption of 45,000 barrels of cement, will be used. All stairways will be of the Philadelphia type, enclosed in stair wells so that they open into exterior balconies. In case of fire employees will thus be outside the fire zone as soon as they reach the stair wells.

For fire protection a complete system will be installed, consisting of outside hydrants, hose houses, and a sprinkler system for each building. Fire mains and sprinkler will be fed by a fire pump having a capacity of 1,000 gallons a minute, which will be installed in the power house and connected with a concrete reservoir. A reservoir supply of water will be stored in tanks 30 feet above two of the buildings, each of the tanks having a capacity of 50,000 gallons. The water for manufacturing purposes will be drawn from two concrete reservoirs the capacity of which will be one million gallons. The buildings have been especially designed for the manufacture of kodaks, cameras and other products of the Kodak company. As Kodak Heights is about a mile beyond the city limits the water supply will be drawn from wells of 150 ft. in depth, located on the company's property. These wells have a combined flow of about 175,000 gallons a day. The manufacturing buildings proper will be located on a plateau at the foot of which the power plant will be erected. This latter is designed to accommodate boilers of 3,000 h.p. and there will be an immediate installation of 1,500 h.p. Electrical energy will be supplied by three steam-driven generators, with a capacity of 1,000 h.p. An important feature of the power plant will be a chimney 200 ft. high and 9 ft. in diameter at the top. To meet the requirements for the manufacture of sensitized material there will be a battery of three ice machines with a capacity equal to the melting of five hundred tons of ice in twenty-four hours. Rest rooms and dining rooms will be provided for employees and everything in connection with the enterprise will be carried out on the most modern lines. The buildings were designed by Mr. C. K. Flint, architect, Toronto. The general contractors are Messrs. C. E. Deakin, Limited, of Montreal.



Reinforced Concrete in Theory and Practice* (Conclusion)

By Alexander Melville, C. E.

A good contractor, having secured a contract, studies the plans thoroughly to consider how he can do the work most expeditiously and economically.

The first point he must decide is the lay-out of the job—where his plant is to be placed, whether his steel is to be assembled on the job or in his yard, whether to use hoists, cranes, or a movable mixer and spout.

His next consideration will be the arranging of a staff. This, of course, will depend on the nature and size of the work. If the job is of considerable size he will have a resident manager, directly responsible to his office for the carrying out of the work.

Directly in touch with the manager will be those in charge of the various departments of the work—carpenter foreman, steelwork foreman, concretor foreman, excavator foreman, timekeeper, and book-keeper. In touch with these head foremen will be sub-foremen, or gangers, over each squad.

Having settled his staff, the question arises how the work is to be carried out—every part to be tackled at once or in sections, and which section first—with a view to continuous employment of a full staff of men throughout. This is often one of the most difficult parts to manage.

Take the case of a building of two wings and a cross building—a U on plan. A good method to adopt in this case would be to make a start on one wing first, and then put the joiners on to the other while the steel is being laid and concreted in at the first wing. It would not be difficult, if this method of working the various trades on alternate wings can be carried out, to carry on the work at full bore throughout. This is, of course, a simple case; others I have come across are very difficult to plan.

If work is carried on in a spasmodic fashion, as in the instance already taken, if both wings were carried on simultaneously with the same trade, a contractor will never make a satisfactory job. He would continually be taking on complete gangs, and would thus find it difficult to get a good set of men. Work would be slow, and, being carried out by casual labour, not of first-class order.

Methods of Timbering

Having made all preliminary arrangements, the contractor must consider the method of timbering to be employed. If he is wise, he will send a typical drawing to the job, showing generally how the foreman is to plan his work. This typical drawing is usually sufficient, and an efficient foreman will adopt the method shown to all details of the work.

In fixing on a method, the two main points for consideration are "ease in striking and adaptability to alteration." Such a thing as a wall form need only be considered from a point of view of ease in handling and strength for continual re-use.

But in the case of column casings, one must consider as well as the foregoing, adaptibility to alteration. The columns on the second storey of a building are invariably of smaller cross sectional area than those immediately below them, so that if the casings are to be used over again they must be built with a view to saving as much labour as possible in alteration.

We find the same problem in beams and in floor slabs due to alteration in beams, but not to the same extent as we come across in columns.

When a floor is concreted the order in striking is columns, beam sides and floor slabs, the underside of beams being left until long after the rest has been cleaned away.

This is the order that must be considered when one is planning the timbering, unless he is prepared to use the job as a timber store. When a floor is struck for the purpose of using the timber above there are no struts left but those under the beams. It is therefore inadvisable when timbering for the next floor to place struts anywhere but above the beams, the concrete in the floor slab being too green to take much load. Thus it becomes advisable to support all the timbering on struts above the beams, and this is the method of support almost universally employed. As a rule, a cross-head is placed on the top of the strut, and on this the beam side forms rest. Among the side of the forms a runner is fastened, and on this runner rests the joists for the floor slabs. It is thus possible to strike everything else without disturbing the struts and timbering of the underside of the beams. Unless great care is taken, considerable damage is done to the timbering—particularly that for the floor slabs—when striking.

A method sometimes employed in America, but which I have never seen here, is to use a double-horse for lowering forms. This consists of a light movable framework not unlike an inverted four-legged table. These legs reach close to the ceiling, and between each end pair is stretched a rope into which the timber is placed. The ropes run through pulleys, and are then passed down, and the forms are lowered with motherly care.

I have found quite a successful method is to make our struts built, composed of No. 2, 6-in. by 2½-in., with 2½-in. distance pieces every 4 ft. or so apart. When striking, a handy scaffold can be formed by placing runners through the struts, supporting adjoining beams and resting on the distance pieces. On planks placed in these runners the men striking can work and hand the forms down carefully.

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*Continued from last issue.

Timbering is a very heavy item in reinforced concrete work and on which is a considerable drain on a contractor's resources, as it has to be used over and over until it is scrap before he gets a full return for his expenditure. When their accounts are due, timber merchants will not be put off the way contractors are by quantity surveyors. A contractor naturally tries to save as much in his timbering as possible. Some try to save by using material of small scantling, but this is false economy. There is relatively more value to be got out of material of stouter section, particularly with boards. A standard thickness for these should be 1½-in.; anything less is liable to much damage in striking. Beam bottoms particularly should be 2-in.

Efficient Handling of Steelwork

A contractor had also to consider handling steelwork in the most efficient and least costly way. Let us hope, for the sake of his finances, that he has not estimated on the figure specialists inform us the labour cost is. For ease in working the steel should be laid out in separate stacks of the various scantlings, and, where possible, in separate stacks of the various lengths as well. The workers can then find any bar that is required immediately. This takes some labour on the arrival of material, but it pays.

Before it is placed on the forms, all the steel has to be bent to some shape or form, and this is most conveniently executed without the use of any power-driven machine. There are many useful hand machines on the market, such as the "Kenendy," but all I have come across are slow when dealing with large sections. For bars of 1-in. diameter and down they are handy and make a good job. Above that they are usually worked by means of a ratchet, which is slow work; or, if not, the stain is such that some part is apt to give way. A stoppage is an expensive matter, and one cannot always keep a complete stock of spare parts. I find the simplest and most effective method of dealing with all sizes except the highest is by employing tubes with strong ferrules at the ends. One merely slips the tubes over the rods so that the end coincides with the position of the bend, and pulls the other end round to the required angle. Those tubes are of varying lengths and strength, depending on the diameter of the bars to be bent, but a handy length for bars up to 1¼-in. diameter is 6 ft. They are not expensive, and a stock can be kept. Their fault is that they tend to burst at the ends, so it is wise to have long strong ferrules, screwed or shrunk on. For bending stirrups a small tube 18-in. long may be used, as already described, or, what is probably the most handy, a steel claw. This claw is like a two-pronged fork, the prongs being shaped on side view like a mark of interrogation.

When the steel is bent and the stirrups made, say, for a beam, the various parts have now to be assembled. This is best done on trestles so that men may work all round it with ease. The beam being built, it is placed in position on the shuttering already prepared for its reception. It is necessary to keep the steel from resting on the boards when concreting, and a convenient method of doing this is placing little wedge-shaped pieces of concrete on the forms to begin with, and then resting the steel on these. These blocks are made of rich concrete in moulds and in lengths corresponding to the widths of the beams in which they are to be placed. In section they are about ¾-in. deep, and varying in width from 1½ at the top to 1-in. at the bottom. Being of concrete, they are not removed, but are concreted in, and, being wedge-shaped in section, there is no fear of them falling out on removal of the centering. When the steel is all placed in position the next process is concreting.

The mixing of the concrete should be by a mechanical mixer of the batch type, which gives the most satisfactory results. From a contractor's point of view also it is the most economical, and allows of much more speed in working than mixing by hand. From the mixer the concrete must be conveyed rapidly to where it is to be deposited, and this may be done by barrows and hoists, cranes and skips, or lifting buckets direct from the mixer, depositing into a bin at the level required or into the funnel of a spout. The mixer has its merits depending on the nature of the particular job, the main thing being to deposit it rapidly and without dropping from a height.

The concrete must be well tamped in position and carefully worked round the rods so that it will adhere everywhere. Most tampers in the market, I find, are just too heavy for general work, and tend to tire the men and induce them to scamp the tamping whenever they are not watched. It is quite possible to make a good job with a light tamper if used well, as with a heavy one. For beams I find the best type of tamper to be a ½-in rod bent at about 2-in. from the bottom at right angles and slightly feathered. With this the concrete can be well worked round stirrups and rods. To make a good face on walls of beam sides there is nothing better than a shovel worked up and down against the shuttering. For floor slabs a ½-in. plate, 6-in. by 6-in., rivetted to the end of a handle answers well. Another good method is to use a wooden roller, which has this advantage—that it is not so apt to jar the work by causing vibration in the forms.

When filling columns and walls it is desirable to hammer the form with wooden mallets. This aids in giving a dense concrete and helps to make a smooth finish. In concreting floor slabs and beams it is well to start at the farthest point from the hoist when it is being deposited from barrows, so that no wheeling will be done over green concrete. It is advisable also to have an experienced man stationed underneath to watch for any deflections, so that work can be stopped at once and extra staying or wedging executed before initial set takes place.

In few jobs is it possible to finish a floor throughout in one day, so the question arises how and where to make a stop. These should be made as near as possible to the centre of the span, and the stop should be made vertical against a board placed on edge for the purpose. When starting next day this joint must be thoroughly wetted and brushed before depositing fresh concrete, and in some cases coated with a rich mortar, or, if necessary, the face roughened.

Before depositing any concrete the forms should be well watered, and, of course, it is necessary also on deposited concrete, for about a week after laying. It makes a sounder concrete and prevents cracks due to quick drying.

Where a floor is finished, and joiners have erected the cases for the columns above, and more so when columns and walls have been concreted and joiners start to lay the boarding for the floors, shavings and sawdust accumulate on the top of the concrete of columns and walls. No temporary handy covering I know of will keep the concrete free from this. The best method to get rid of it before concreting is started, and it must be got rid of, is to form traps in the column cases and the wall shuttering at the level at which the concrete was stopped. The concrete surface is then swilled with water, and the shavings float off through the traps or doors. If plenty of water is used, a thoroughly clean surface can be obtained on which to start depositing the fresh concrete. It is, of course, advisable to see that the gang is not too quick.

I have now covered a fairly large field in reinforced concrete work, and tried to express how it strikes a contractor who has been in the midst of its troubles for a considerable number of years.

Economical Proportioning of Concrete

ECONOMICAL proportioning of concrete does not always consist in using the leanest possible mixture, writes Sanford E. Thompson, Consulting Engineer. If the quantity to be laid is small, it is sometimes cheaper to use materials at hand, selecting the proportions arbitrarily and adding an excess of cement to insure the required strength and water-tightness, rather than to make the tests required for the more scientifically proportioned mixture. On the other hand, upon large or important work it pays from the standpoint of dollars and cents to make thorough studies of the aggregates, carefully grading the materials so as to use the smallest possible quantity of cement, which is always the most expensive ingredient. This fact has been seriously overlooked in the past, and thousands of dollars sometimes have been wasted on single jobs by neglecting laboratory tests and studies or by errors in theory. By adjusting the proportions of the aggregates instead of selecting them arbitrarily, a concrete of equal density, strength and water-tightness may be made almost always with the use of less cement. On a certain job, for example, where water-tight concrete was required, a net saving was effected of 74 cents per cubic yard by carefully grading the materials, the resulting concrete being as watertight as the richer mixture, having proportions selected by judgment.

Reinforced Concrete Bridge at Toronto

THE city council of Toronto has let the contract for the construction of a reinforced concrete bridge on Crawford street over Bellwoods Park, Toronto, to Messrs. Wilson, Townsend & Saunders, engineers and contractors, Toronto. The bridge will consist of three arch spans, one of 90 ft. and two of 63 ft., with concrete approach arches. There will be a 21-ft. roadway and two 6-ft. cantilever sidewalks. For the arch ribs welded structural steel reinforcement will be used, and cold twisted steel for the other portions of the structure. The piers will be constructed of 1:3:5 concrete. A 1:2:4 mix will be used for the main arches, deck arches, floor system and for the floor and sidewalk slabs, except the surface veneer layer of the latter. For the sidewalk balustrade the mix will consist of one part cement and four and one-half parts crushed granite. The pier excavations—except in the case of two piers in the approaches, which will be supported on piles—will be taken down to bed rock or to such depths as may be necessary to secure a good foundation. The borings at the location of the work show rock at a depth of 20 ft. to 34 ft. The main arches will be constructed in transverse sections beginning at the spring lines of each, and from both ends of opposite arches simultaneously. To ensure symmetrical loading the deck arches and floor system of the spans will in each case be constructed from opposite ends of spans at the same time. All surfaces exposed to the view will be finished by rubbing with sandstone or carborandum brick, after which a cement grout wash will be rubbed in. Other face surfaces exposed to direct weather conditions will be rubbed and a final finish of wet cement grout will be applied with a brush. The construction will be followed as far as possible in the following order: middle arch piers, end arch piers, approach piers, arch rings, approach arches and abutments, deck arches and stringers for all three spans floor slabs and sidewalk construction. The work will involve an outlay of about $45,000, and operations will be started without delay.

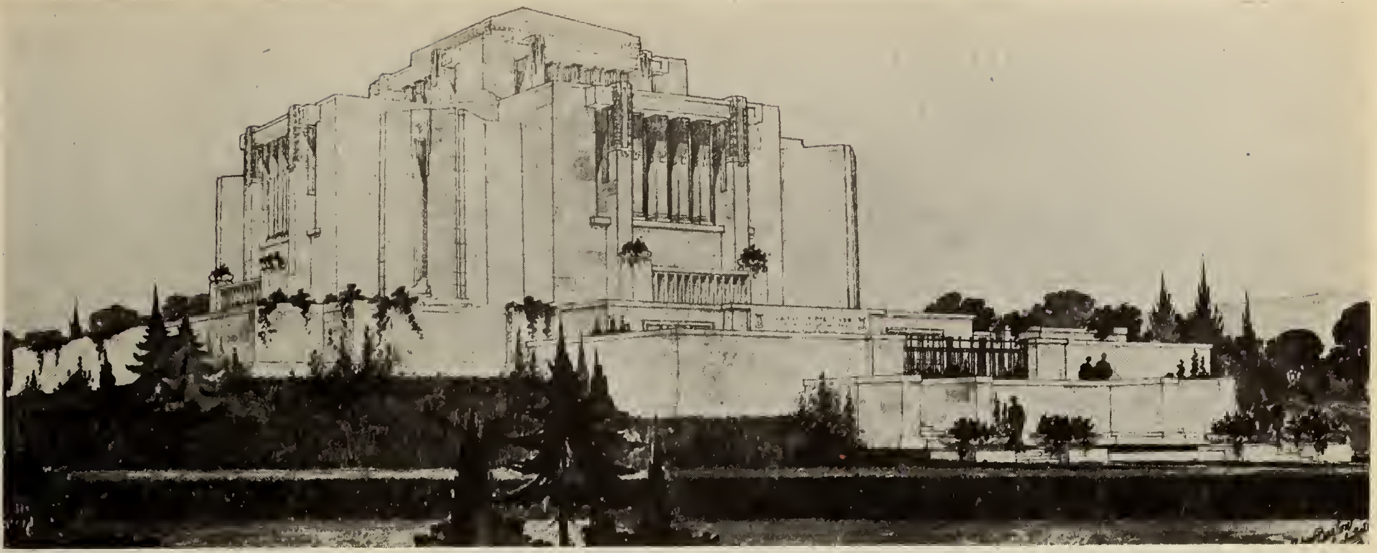
How to Patch a Concrete Floor

WHEN a cement floor surface begins to wear it is often desirable to patch it. Leonard C. Wason, president of the Aberthaw Construction Company, Boston, in a recent paper, states the right way and the wrong way.

The Wrong Way.—Commonly a sand and cement mortar is made, some cutting is done and the mortar is put in and scrubbed with a steel trowel until smooth. It is then covered up for a while. If the concrete under the patch is left dry, it soaks up the water of the mortar. As a result, the mortar does not set. If the room is dry or hot the surface of the patch dries out and for the same reason it does not set. If the concrete under the patch is dusty the patch does not adhere to the concrete. If the materials in the mortar are not suitable, naturally the patch wears badly, particularly as it is obviously located at a point of severe wear.

The Right Way.—Cut down the worn place at least one and a half inches. This cutting should be carried into the strong unbroken concrete and the edges should be cleanly undercut. The bottom of the cut should then be swept out, clean-blown out with compressed air or a pair of bellows, if available, then thoroughly wet and scrubbed with a broom. In this way, small loose particles of broken material which the chisel has driven into the surface are removed. A grout made of pure cement and water about the consistency of thin cream, should be scrubbed into the pores with a broom or brush, both at the bottom and sides of the cut. Following this a stiffer grout, about the consistency of soft putty, should be thoroughly compressed and worked into the surface, which has already been spread with grout. Finally, before the grout is set a mortar made of one part cement to one part crushed stone or gravel, consisting of graded sizes from ½ inch down to the smallest excluding dust, should be thoroughly mixed and put in place, then floated to a proper surface. Cover with wet bagging, wet sand, sawdust, or other available material. All trucking should be kept off and the surface kept thoroughly wet for at least one week or ten days.

If a particularly hard surface is required, 6-penny nails are sometimes mixed with the mortar and other nails stuck into the surface when the patch is finished. This will produce a surface which is extremely hard and durable.



Alberta's Proposed Mormon Temple

REPRODUCED herewith is the architects' perspective of the proposed Temple which is to be erected at Cardston, Alta., for the Mormon Church at an estimated cost of $300,000. The foundation work is now practically completed. The building will be of permanent construction in every detail and reinforced concrete with Kootenay stone will be employed largely. The architects, to whom we are indebted for the accompanying view, are Messrs. Pope & Burton, Salt Lake City, and the Superintendent of Construction is Mr. H. A. Christenson, of Calgary. The contractors for the masonry work are the Kootenay Gravel & Monumental Works, Nelson, B.C.

The World's Heaviest Office Building

THE Equitable building, now under construction in New York City, from its great area presents an interesting problem in heavy erection. It will be the heaviest office building in the world when finished. The steel erection was made especially difficult by extensive cross-lot timber bracing, which holds the basement retaining wall until sufficient steelwork has been installed to take the load. It was necessary to set the derricks and with them erect the steelwork for the three storeys below ground, all without damage to the cross-lot bracing.

The new building will be about 160 x 312 feet in plan and about 500 feet above the street and 65 feet below at lowest point. It is considered a 36-storey building, but there will be intermediate floors at the third and thirty-fourth floor levels, making thirty-eight floor levels.

The elevators, stairways, lavatories, smoke-stack, etc., will be placed in the centre or core of the building. All offices will have an exterior exposure.

The steelwork was erected to the second floor by six steel guy derricks, with 76-foot masts and 65-foot booms. The heaviest column weighed 32 tons. Above the second floor the heaviest piece to be handled weighs about 16 tons, and 15-ton derricks with 90-foot masts and 85-foot booms replaced the original six. The longer reach of these lighter derricks rendered them much more useful in handling material from the street.

After the steelwork west of wall columns 7 and 125 was erected, derricks proceeded to erect the basement steelwork eastward, moving forward along the basement steel, erecting steelwork ahead, similar to the moving of a traveller. In this way, liability of accident to the cross-lot bracing was reduced, and the expense of building bents for supporting the derricks was eliminated.

The total steel aggregates 33,000 tons. It is shipped to Greenville, N.J., lightered over to New York City in the vicinity of the Battery, and trucked to the job. Each derrick handles the steel from the street for its particular section.

Crushing Brick for Concrete

Crushing old brick for concrete used in fireproofing the new city hall in San Francisco has been under way for some time, and the method is reported to give satisfactory results at a low cost. The brick encumbered the site of the old city hall, where great quantities of them have lain since the wreck of that structure in 1906. In preparing the site as part of the new civic center the removal of the brick debris was quite an item, and it was finally decided to make some use of them in the civic buildings. Accordingly, a gyratory rock crusher was installed, which receives brick and the adhering mortar in chunks, just as taken from the ruins and reduces them to 1½-in. size or less. From the crusher, to which wagons dump directly, the material falls upon a bucket conveyor that elevates it to a bin, which in turn feeds by gravity into the wagons. No screens are used, and no trouble has been experienced from excessive lime or brick dust content. The ground brick are used in place of rock in 1:2:4 or even 1:3:6 mixes, the concrete being used only for fireproofing, in slabs, etc. It is interesting to note that legal action against the city for patent infringement has been taken by a company owning patents on a process for fireproofing steel structures by the use of burned clay mixed with concrete.

Ontario Commissioners' Valuable Report on Highway Administration

THE activities of the Public Roads and Highways Commission of Ontario are reflected in an instructive and voluminous report which has just been submitted to the Lieutenant-Governor in Council.

In the first place the Commission presents its Findings and Recommendations. The more noteworthy of these, as summarized in the report, are given below.

The Appendices, which comprise some two hundred pages of material, accompanied by illustrations, maps and plans, embrace every conceivable phase of the subject and matters correlative. The importance of developing the agricultural interests is considered carefully, emphasis being laid upon the desirability of a governmental policy of striving to increase the agricultural and mineral output of the country. A close view is taken of the relation between the city and the farmer, the purpose being to show the vital importance of an agressive road policy—and the facts and figures adduced accomplish this end. The municipal and other resolutions presented to the Commission, together with a summary of evidence, are placed on record in the report. Following this section are road mileage and traffic census tables.

An analysis of automobile registration in the province of Ontario is interesting by virtue of its completeness, every detail being given and comparisons made with the status of United States cities and states.

Perhaps the most valuable of the Appendices is one which comprises a compendium of highway organization in Canada and the United States. A summary of the information relating to the various provinces of the Dominion is presented herewith, after the Findings of the Commission. The particulars of highway improvement in the United States relate to Massachusetts, New York, Pennsylvania, Ohio, Michigan, Minnesota, Wisconsin and California, and comprise details of area, population, wealth, taxation and general expenditure, with concise statements showing the progress of state highway work, the line along which development has proceeded, and the cost of construction and maintenance. This is a particularly valuable feature—one which those identified with highway administration will find repay careful study.

A historical sketch of road development in Ontario outlines the policy of public works followed by the province during the last century and is illuminating as to the strides that are being made in the present day. The remaining appendices comprise: Township Roads—Statute Labor and Expenditure; Road Improvement and Land Values; Memorandum on Assessment in Ontario; Data for Chart of Farm Production; Toll Roads; Note on Report on Location of Road Material; Urban Municipalities of Ontario; arranged in order of Density of Population; Township Road Expenditure, 1900, 1905, 1910.

Concrete road construction at Sarnia, Ontario.

The statistics of acreage and population relating to the urban municipalities of the province show care in the tabular arrangement and will be found an instructive reference.

Generally, the Report is a mine of information on highway organization and administration, and the arrangement of the material is excellent.

An outstanding characteristic of the Report is its conciseness. The scope of the publication is so wide that its volume might easily have been three times as great, and yet in their foreword the Commissioners make it clear that their intention is to embrace only a preliminary survey of their subject. They suggest a permanent advistory commission to frame the details of technical policy.

The Public Roads and Highways Commission of Ontario is made up of Messrs. C. A. McGrath, W. A. McLean (Provincial Engineer of Highways) and A. M. Rankin, and was appointed last July.

Following are the extracts to which we have referred above:

SUMMARY OF RECOMMENDATIONS

1.—**Control.** The committing of the actual control and management of the roads, so far as possible, to local bodies—the county councils, or commissions appointed by them, boards of trustees, etc.

2.—**Finance.** The blocking out of a definite amount of work to be begun in 1915, and to be completed

Reinforced concrete arch, 65 feet span. York county, near Kleinburg.

about 1930. Cities should contribute at least to the construction and upkeep of the roads in their immediate neighborhood. The permanent construction work should be regarded as a capital expenditure, and should be financed by bond issues designed to reach by 1930 a total sum of about $30,000,000, apportioned as follows: to the province, (including the capitalization of some of the revenue from motor fees, $12,000,000; to the counties, $12,000,000; to the cities, $6,000,000.

3.—**Maintenance.** The provision for proper maintenance for every mile of permanent road work, the funds for this to be obtained from current revenues.

4.—**Township Roads.** The devoting of special attention to the improvement of township roads.

5.—**Tax on Motor Vehicles.** The putting of taxation of motor vehicles on a systematic basis, which the Commissioners estimate would produce about $400,000 in the earlier years.

6.—**Central Highways Department.** The development of a central Highways Department under the headship of a Minister of the Crown, with, as its principal permanent officials, a Deputy Minister and a Chief Engineer, and in addition an unpaid Advisory Commission of men with a genius for accomplishing big things.

In view of the impossibility of installing a new plan of road development as outlined in this report before 1915, the Commissioners believe that: (1) Counties now operating under the Highway Improvement Act should be encouraged to continue as usual their road work this coming summer, and that the regulations under the Act should be made as elastic as possible so as to allow the other counties to begin work and thereby take advantage of the aid thereunder. (2) There should be created a sufficient organization to carry on this summer the following investigations: (a) a motor survey of principal roads to determine their physical condition; (b) a traffic census to determine the present road needs of the province; (c) an investigation of main township road conditions; (d) an investigation of the Hamilton-Toronto, and Ottawa-St. Lawrence Roads, obtaining plans and specifications of same; (e) an investigation designed to outline a plan of market roads for counties not now operating under the Highway Improvement Act; (f) a determination of suburban areas about principal centres.

HIGHWAY ORGANIZATION IN CANADA

QUEBEC

Highways are divided into two classes—

(1) Provincial roads built entirely by the Government on its own initiative and under authorization of the Lieutenant-Governor-in-Council. The Road Department determines the location, nature and cost of the work, takes possession of such roads (whether or not subject to municipal authority), may expropriate rights of way and fix the share per mile or part of a mile to be paid by the municipalities interested. The latter may by resolution propose a certain contribution based either upon a general tax collection roll prepared for the purpose and submitted to the Department, or by means of a special assessment on ratepayers bound to maintain roads.

(2) Municipal roads built by the municipalities according to the two following systems:—

(a) (According to the Act of 1911). The Government grants the local municipalities half of the amount expended on macadamizing and gravelling, the maximum grant being in the first instance $1,000, in the

Applying tar—to prevent dust and preserve the road surface. One-half gallon the square yard.

Dundas street, near Toronto. Carpeted with tar and fine gravel.

second $500. The Government also refunds one-third of the amount expended for replacing wooden bridges (less than eight feet span) by concrete culverts or concrete or corrugated steel pipes. When maintenance of earth roads is in charge of the municipal council, the municipality is entitled to an annual subsidy equal to one-half of the amount expended, the maximum grant being $400 if all the roads are under the control of the council, and $200 if the by-roads only are so controlled. Road plants are loaned to the municipalities—one-half of the cost of operation being paid by them; an instructor with a Government-paid salary is also furnished.

(b) (According to the Act of 1912). The Government is authorized to borrow $10,000,000 on debentures. Local municipalities are granted appropriations for this fund, limited in the case of most towns and village municipalities to the amount required for the improvement of the main road only. County councils may also take advantage of this system, although up to the end of 1913 only one had done so. These municipalities are required to pay two per cent interest on every appropriation for a period for forty-one years, the remainder of the interest and the sinking fund being provided by the Government. The initiative must be taken by the municipalities themselves, in the form of a by-law with the deposition of promisory coupons. Roads and bridges operated under this Act remain (or become by virtue of the Act) the property of the municipality, but all macadam work done in the Province under either Act is subject to the direction of the Department of Roads, which imposes upon the municipalities specifications with inspection and acceptation of the particular roads. A monthly report to the Minister is required from the municipalities, giving estimates of the work performed and unfinished and of financial details of work being done under the officer of the Road Department. Arrangements exist whereby municipalities not wishing to assume the interest indebtedness may raise contributions by special assessment, and in cases where the roads are under charge of the corporation, the amounts paid for interest on the Government grant are deducted from the amount due from the ratepayers responsible for the maintenance of such roads. Municipalities may not benefit by both Acts.

Reinforced concrete bridge with concrete railing. Markham Township, County of York.

For the operation of the first Act (i.e., of 1911) the Legislature grants each year an appropriation out of the ordinary revenue ($250,000 in 1913). The interest and sinking fund for Government debentures under the second Act go to the consolidated revenue of the Province. Under these inspectors are road-masters appointed by the municipalities.

Nova Scotia

The head of the Highway Department is the Road Commissioner appointed by the Lieutenant-Governor-in-Council; he is an official of the Department of Roads and Mines, and has under him an assistant commissioner who must be an engineer of experience. The latter has control of two travelling inspectors to report to the commissioner as to the condition and requirements of roads and short bridges in the various municipalities. Under these inspectors are road-masters appointed by the former and acting as foremen.

Highways are divided into first, second and third classes on a traffic basis; at the present time bridge grants are limited to structures on roads of the first class, but may be extended to the other two if traffic conditions should warrant it.

Municipal road revenues are derived from the Government grant, and from commutation of Statute Labour. Co-operation between the municipal authorities and the road inspectors is encouraged. No bonds are issued and assessment is entirely under the control of Municipal Councils. There is also a "Motor Vehicle Act Road Improvement Fund," which is part of the Provincial Revenue.

New Brunswick

The Provincial Highway authority is the Provincial Road Engineer, who is an official of the Board of Public Works, and is appointed by the Lieutenant-Governor-in-Council to hold this office during pleasure. He has the supervision and general control over the building, maintenance and repair of the highways of the Province, and has under him County Inspectors of Highways wherever the latter are appointed to have control over the supervisors for each highway division in any County. There is no classification of roads.

A road tax is annually levied for the general repair and maintenance of highways in each county, every male person between the ages of 21 and 60 resident in the parish paying a poll tax of $1.50, and an amount not less than one-fifth per cent upon the assessed value of real and personal property including income. This last income tax is extended to all persons, companies and estates. Municipalities may increase the rate of this road tax, which is paid to the County Treasurer, and is expended on the order of the Minister of Public Works in the division where it is collected.

In lieu of the road tax, resident ratepayers may perform Statute Labour before July 15th in each year; if notice is given before May 1st, Road Supervisors may call upon residents to give Statute Labour in lieu of taxes.

British Columbia

The Department of Public Works has control over all roads and bridges in the Province—the executive head being the Public Works Engineer, who must prepare plans, maps and estimates for all public works, and act in a general advisory capacity. The Department is authorized to make road alterations and expropriate any private road after due notice, compensation being paid for such lands only as have buildings or form part of an orchard or garden.

A road tax of $2.00 per head is imposed on all males between the ages of twenty-one and sixty in the cities and district municipalities—military persons being exempted.

Saskatchewan

The Provincial highway governing body is the Board of Highway Commissioners, consisting of three members appointed by the Lieutenant-Governor-in-Council, one of whom shall be appointed as a chairman. They receive salaries and have duties assigned to them as may be determined upon from time to time by the Lieutenant-Governor-in-Council. There is associated with the Board for advisory purposes a committee of two members, one appointed annually by the Provincial organization representing rural municipalities and one by the Provincial organization representing urban municipalities. These members are allowed such per diem expenses and allowances as are fixed by the Lieutenant-Governor-in-Council for attendance at meetings where they are requested to be present by the Chairman of the Board of Commissioners. This Commission reports to the Minister of Public Works annually. Its duties are:—

(1) To lay out, plan and determine upon a system of public highways for the province which may from time to time be altered or modified as the Board may determine.

(2) To determine upon the most feasible and economic methods for constructing, improving and maintaining public highways.

(3 To furnish the officers of the municipalities with information respecting the construction, improvement and maintenance of public highways.

(4) To appoint such engineers, inspectors and officers as are necessary for the proper carrying out of the duties of the Board and the provisions of this Act. All such appointees shall receive such remuneration as shall be determined by the Lieutenant-Governor-in-Council.

Road construction camp in Lennox and Addington.

The Board may with the consent of the Minister of Public Works spend such sums of money as are deemed advisable upon construction and improvement of Public Highways, and it may enter into agreements or make contracts for construction of or improvements on such highways. The Lieutenant-Governor-in-Council retains the right to make such general regulations regarding the expenditures of the Board as may be deemed expedient.

An attempt was first made to divide the expenditure in all municipalities equally among them, but this was abandoned on account of the varying needs of conditions met with in the various districts. The original division of funds in 1912 for road improvements and bridges was $1,300,000 for the former and $300,000 for the latter.

The attention of the Board was directed chiefly toward the main highways but it was found there were several roads, bridges, etc., which, though not on main roads, were beyond the power of the municipalities to construct and were taken over by the Board. The Board assists municipalities to the extent of 50 per cent of the cost of improvements made when these improvements are according to the regulations adopted by order of the Lieutenant-Governor-in-Council.

Educational work has been attempted through the distribution of bulletins and specifications, by correspondence and through the staff of inspectors. A limited amount of experimental work has been attempted with only partial results.

The Board has instituted a Road Drag Competition with excellent results among the different municipalities. The Board has so far devoted its energies to the main roads, leaving the feeders to the municipalities, except insofar as concerned its advisory capacity. The Board finds that best results are obtained by its own road gangs who are building roads exclusively, and better work is done at a lower cost than rural gangs recruited from the farmers.

All bridges over 20 feet span are constructed and maintained by the Commission, which also operates and controls all ferries and drainage and water supply throughout the Province, with control covering all surveys for purposes of road diversion.

Methods and Cost of Constructing a Bituminous Gravel Concrete Surface

THE use of gravel aggregate in the construction of a bituminous concrete surface in New York State is discussed by S. J. Stewart in the Proceedings of the American Society of Civil Engineers.

The writer designed a pavement consisting of a mixture of asphalt and gravel in the proportion of 1 cu. yd. of loose gravel to an average of 20 gals. of asphalt, the gravel containing not less than 10 per cent. of clay. The gravel was bank run, the largest particles of which were 2 ins. in the longest dimension, containing sufficient fines to fill the voids partly. The bitumen was a fluxed natural asphalt with a penetration between 10 and 13 mm. when tested for 5 seconds at 77 deg. F., on a No. 2 needle weighing 10 grammes.

The gravel was heated in a mechanical revolving dryer with a temperature of more than 225 deg. F., after which the asphalt, heated to not less than 275 deg. F., was added; then the mixture was placed in a revolving mixer until thoroughly and completely coated with bitumen. The mixture, at not less than 225 deg. F., was spread on the prepared bottom course with shovels from dumping boards and raked to a uniform surface, with hot rakes, after which it was rolled with a self-propelled roller weighing at least 10 tons, until it was thoroughly consolidated.

On some sections of this pavement there was placed ½ in. of gravel screenings containing not less than 10 per cent. of clay which was saturated with water and rolled thoroughly and continuously until a clay mortar had been obtained. This process filled all the surface interstices with a gritty and adhesive substance which made the road practically "non-skid." In a short time the traffic drove away all surplus screenings, leaving a mosaic surface.

A different method of treatment was applied to this form of pavement in the more thickly settled communities. After the mixture had been rolled, it was covered with a coat of hot oil as a seal coat, this seal coat being applied in November. In the following spring, under the action of the sun, the road bled to some extent, and became so sticky in a few places that the oil adhered to wagon wheels, which pulled up some of the top course. This condition could have been avoided if the authorities in charge had covered the pavement with sand or gravel screenings as soon as it became apparent that the hot oil had a tendency to bleed. No material harm was done, however, as the continuous traffic carried sufficient sand and dirt on the pavement so that in a short time the stickiness of the oil had disappeared.

Such treatment obviates the general complaint against the so-called stone-mixing method pavement where a greater quantity of asphalt is used and where the seal coat is of the same consistency as the asphalt binder in the top course proper. These objections arise from the hardness and slipperiness of the surface, which, during the greater portion of the year, make it undesirable for horse traffic because of the former characteristic and to motor traffic on account of the latter.

It is suggested that, where the hot oil is omitted at the time of the original construction, the mosaic surface be covered with a hot oil treatment of one-half gallon per square yard during the following year. With the hot oil as a squeegee course, in place of the seal coat of the same consistency of the bitumen, the pavement proper gives a less hard and slippery surface, which is desirable on country highways.

The writer's experience has convinced him that large plant, costing from $5,000 to $8,000, is not necessary in order to construct this pavement successfully, and that equally good results can be obtained from the use of small mixers costing from $1,500 to $2,000.

This pavement without the oil treatment cost about $0.85 per square yard, and with an oil seal cost about $0.90 per square yard for a pavement 2½ inches in depth. This cost compares favorably with similar figures for mixing-method pavements in other parts of New York State.

The writer quotes from a statement attributed to a superintendent of highways, of New York State, relative to costs of similar pavements of graded stone material, as follows:

Item.	Cost per sq. yd.
1½ in., California asphalt	$1.20
2 in., Topeka	1.20
2 in., Warrenite	1.30
2 in., bitulithic	1.60

The gravel used in this pavement cost approximately $2.35 per cubic yard f.o.b. destination, but where material can be obtained near the site of the works the cost of $0.85 per square yard can be materially reduced.

From observation of mixing-method pavements laid in New York City and vicinity, with graded stone as a mineral aggregate, it is ventured that the percentage of disintegration is as great, if not greater, than in the bituminous gravel pavement laid during the same period of time. In fact, after 1 year's wear, out of a total of 112,000 sq. yds., or 0.04 of 1 per cent. less than 45 sq. yds. of this gravel mixing-method pavement had disintegrated.

The road which received the treatment of hot oil in a squeegee course was dug up in many places during the year following its completion for investigating purposes, and, where removed, the material thrown back retained its vitality to such an extent that the top course healed itself so that a casual observer could not discover where the pavement had been disturbed.

Cracking in Concrete Roads

PROBABLY more criticism of concrete pavements is centered on the cracks which occur than upon any other features of this kind of construction. A. N. Johnson, state highway engineer of Illinois, in a paper before the American Road Congress attributed the formation of cracks to unequal settlements of the subgrade, supplemented by external stress due to the passage of heavy traffic or to the movement of the slab under temperature changes. In commenting upon this, Henry S. Spackman refers to experiments conducted by him which showed that when concrete is mixed as wet as it generally is in modern road work it shrinks during the first twenty-four hours and then expands during the next three or four months, the shrinkage being undoubtedly due to a draining out of the water and the expansion to the continuation of the chemical action, which continues for months and even for years in a continually lessening degree. In view of this shrinking which begins almost as soon as the concrete is laid, it seemed impossible to prevent the cracking of the pavements unless the exudation could be prevented. Mr. Spackman has experimented with the addition of hydrated lime for this purpose, and compared 18 test pieces to which hydrated lime had been added to the extent of 10 per cent. of the amount of cement in some instances and 20 per cent in others, and 9 test pieces containing no lime. During the first twenty-four hours the average contraction for those containing hydrated lime was .007 per cent, as against .015 per cent for the pieces containing no hydrated lime. At his suggestion also the Office of Public Roads laid a short stretch of road at Chevy Chase, Washington, D.C., using hydrated lime, and another was laid near Salisbury, Md. These experiments all lead him to believe that the addition of 10 to 15 per cent of hydrated lime will be found beneficial not only in reducing cracks, but also in eliminating the formation of holes and soft spots. Such addition, he says, not only causes the mortar to hold the water, but the more plastic and viscous mortar eliminates the segregation of the cement from the sand and secures a more homogeneous mixture, lessening the liability of pockets of material deficient in cement.

Violet-Ray Sterilization for Niagara Falls Filters

NIAGARA Falls, N.Y., is to have a municipal ultra-violet-ray sterilization plant. Contract negotiations have been made for a 35-lamp installation with the R. U. V. Company, Inc., of New York. "Pistol" lamps will be used, seven in each of five concrete canals, although the company estimates twenty-five lamps only will be required to handle the capacity of the plant, 16,000,000 gal. daily.

The cost of the canals and lamp installations will be $19,800, while the city will erect a building and transformers to change the current from alternating to direct, at a cost of $2,200. Approximate costs per 1,000,000 gal. for maintenance are guaranteed as follows: Current, 7 cents; lamp renewals, based on a 2,900-hour life, 60 cents.

About 1 gr. per gallon of coagulant and 5 lb. of bleach per 1,000,000 gal. have been used at this plant, the total cost of chemicals running about $1.50 per 1,000,000 gal. It is hoped that the coagulant can be cut in half and still give a clear water, in which case the ultra-violet-ray installation will prove economically advantageous.

The channels in which the water will be sterilized will be of concrete, 2 ft. wide, 3 ft. deep and 26 ft. long, affording a contact period of 30 seconds with the ultra-violet rays. The lamps are spaced 30-in. apart and in front of each is a baffle of wired glass in which a rectangular opening is cut to divert the water against the quartz tube.

Quebec Leads in Road-Making Instruction

At the present time when the good roads movement is developing rapidly throughout Canada, it is encouraging to find that a school for the practical study of road-making, which was established at Acton Vale, Que., following the inauguration of the government's road policy, has justified its existence. It will therefore be of interest to mention that more than 175 men from different parts of the Province of Quebec attend the school. There are two sets of machinery on the ground, and four different kinds of road work are being carried on; gravel, macadam, asphalt and concrete. The school is in charge of competent engineers from the Department. The programme for this year's work includes the building fo four new highways by the government. Government subsidies for the improvement of roads are being constantly asked for. There are now 174 road-making outfits in use through the Province, which has been divided into 12 sections and an inspector appointed for each. Mr. A. M. Evans, chief government engineer of highways for the Province, made a survey of the Sherbrooke to Derby line road a few days ago. Large gangs of men are now at work, and the number will be increased shortly. Dangerous railway crossings will be eliminated and sharp curves done away with. When finished the road will be one of the best in the Dominion.

North Toronto's Sewerage Project

The new sewerage system for North Toronto which the city must construct under the terms of an agreement by which the township of North Toronto was annexed to the city, is estimated to cost more than $4,000,000. Two systems were considered originally; One contemplates separate sewers for storm overflow and for ordinary purposes, at a cost of more than $6,000,000. The alternative system, which is the one recommended, will have sewers to serve both purposes at an estimated cost of $4,144,256. The system is to be in two divisions, one with lateral sewers, trunk sewers, outlets and disposal plants. The sewage from the lateral sewers, 144 in number, will flow into 13 local trunk sewers, extensive enough to provide for the future development of the district. Of the two storm sewers which will be necessary, one will pass through the Waterworks Park, and the other along Bayview Avenue to the Don River. The sewage disposal plant will include tanks for the treatment of storm water and Imhoff tanks for sewage, and the plant will be so built that additions can be made as required without disturbing the general plant. The second division of the system will be somewhat similar. There will be 139 lateral sewers, 7 local trunk sewers, 2 storm outlet sewers, and one outlet sewer.

What will probably amount to the largest yardage of concrete highways ever built in a single year within a radius of forty miles was started in May when Milwaukee, Sheboygan, Racine, and Kenosha Counties, Wisconsin, commenced work on fifty-two miles of concrete roads.

Municipal Engineering Work at Hamilton

THE annual report of the City Engineer of Hamilton (Mr. A. F. Macallum) just to hand is instructive as to the scope of the work done in the various engineering departments of a growing city with a population of 100,000. During 1913, Hamilton witnessed exceptional development and the City Engineer's department experienced the heaviest work of a single season in its history. Waterworks construction was heavy, the various city mains being completed, as well as a 36-in. rising main from the pumping station at the Beach. The new 4-foot intake into Lake Ontario, 2,120 feet in length, was laid along with the intake and crib by the contractors, Messrs. John Danforth & Company, of Buffalo, N.Y. This firm also completed the laying of the 4-foot conduit between the wells and the settling basins.

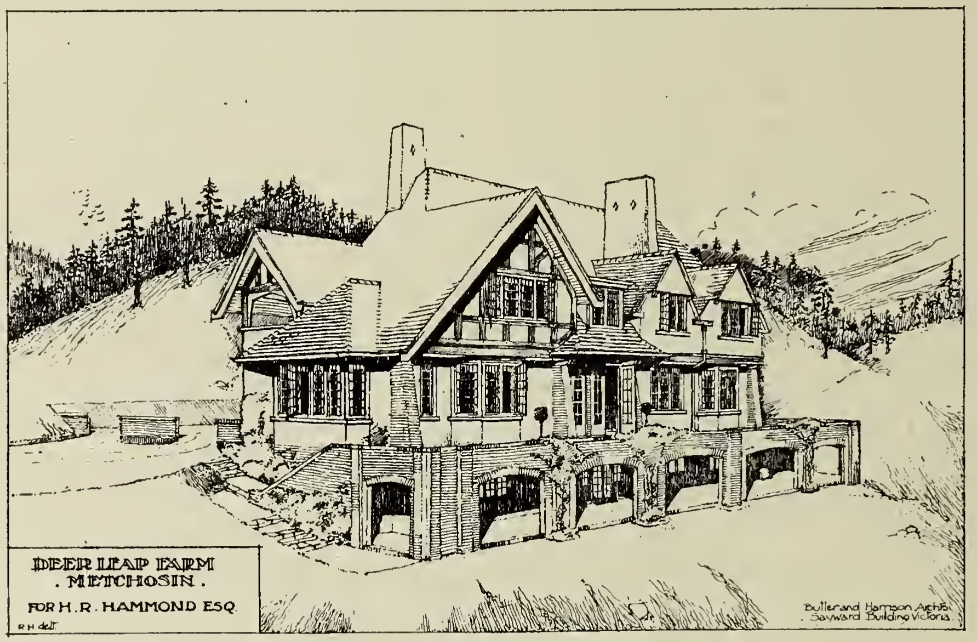
The new pumping station at the Beach, with foundations, has been completed, and pumps, motors, transformers, valves and headers have been installed. This new pumping station has installed four pumping units of six and one-half million gallons each, with foundations and accommodation for two more pumping units of similar capacity.

A new high level pumping station was built at the head of Ferguson Avenue, and four electrically-driven turbine pumps, each of one million gallons capacity, were installed. Two of these units pump to the present high level reservoir, giving a supply for the high level district equal to three times the steam units on the same service. The other two units pump to a standpipe on the mountain top through a twelve-inch main laid during the season. This standpipe, which is one hundred feet high and holds 80,000 gallons of water, was built by The Des Moines Bridge and Iron Company. By placing these mountain pumps at the Ferguson Avenue station, the cost of maintenance and operation was much reduced. The Wentworth street station has been abandoned, and the air compressors and motors have been removed. The head from the Beach pumps is now utilized in cutting down the necessary lift to the high level and mountain top. The new pumping unit at the Beach and high level stations were built and installed by the Canada Foundry Corporation and Canadian General Electric Company.

The necessity of increased reservoir capacity is now under consideration, and also the desirability of installing steam turbines to further insure the continuity of the water supply.

Construction was commenced upon the West End Disposal Works. The grit chambers and sludge beds were finished, also the excavation and piling for the six Imhoff tanks. Three of these tanks were partly built when work was ceased for the season. The secondary fillers of the East End plant were not used during the year, the sewage receiving only sedimentation treatment in the septic tanks. These tanks will be reconstructed to the Imhoff type and new secondary filler beds installed.

A new asphalt plant was built in the east end, on Gage Avenue, capable of turning out 1,500 yards a day. With the two plants running, and good weather conditions, more asphalt pavements were laid than during any previous year. Creosoted wooden blocks and asphalt concrete pavements were also laid upon a number of streets.



An Attractive Victoria Residence

THE picturesque country residence illustrated herewith is characteristic of the type of dwellings that has earned for Victoria its reputation as a city of homes. This residence is being erected by Grayson & Sons, contractors, of Victoria, at Metchosin, a near-by suburb, for Mr. H. R. Hammond at a cost of $20,000. The stucco finish, brown-stained woodwork and gabled architecture give a quaint old-country effect that is further accentuated in the interior, where the beam work and high open fireplaces are all built in Old English style. Messrs. Butler & Harrison, of Victoria, prepared the plans.

The Eldorado Oil Company, lately organized, have secured leases on 1,198 acres distributed throughout the province of Alberta and will shortly commence drilling for oil. The company is capitalized at $250,000.

Proposed G. T. P. Station, Regina.

Constructional News from the Saskatchewan Capital

Correspondence of the Contract Record

Regina, June 26, 1914.

BUILDING work in Regina at the present time is quite active and the outlook for a good season is improving all the time. Mention of many important buildings under construction has been made in previous issues of the Contract Record, but the constructional story of Regina has many chapters.

Reproduced herewith is the architects' perspective of the proposed G. T. P. station for Regina. This building will be connected with the hotel by means of an underground passage. The tunnel, train sheds, power house, laundry and station will cost something like one million dollars. In another view we give a glimpse of the G. T. P. railway hotel now under construction at Regina. The contract price for this building was slightly over one million dollars. The hotel will be named the "Qu'Appelle" and will be fourteen storeys in height. The work of excavation and the putting in of the footings was commenced last year, but some difficulty was encountered in connection with the footings owing to the clay ground. Steel work is now in progress. The third of the illustrations is from a progress photograph of the addition to the Regina hospital.

Messrs. R. J. Lecky & Company have already commenced the work of erecting one of the towers on the Regina College building. The building proper was erected two years ago, but the contract for the two large towers was only let re-

Addition to Regina hospital under way.

cently. The completion of this work will give the college building a decided improvement in appearance.

The city of Regina has accepted an offer for $1,505,000 worth of debentures for local improvement works. This will provide sufficient funds to carry on all the improvement works decided upon. As soon as more money is required for this work, the city is in a position to market an additional debenture issue of $1,500,000 approved by the ratepayers several months ago.

Two new schools will be erected in Regina during the present year—one a six-room building to be built at Premier Place subdivision and the other a cottage school to be built in City View.

Still another industry has been added to Regina's growing list Alexander Harrison, of Minneapolis, in conjunction with Regina business men, having arranged to erect an ice factory. The factory will have a capacity of thirty tons daily.

A new vaudeville theatre is to be erected in Regina, excavation having already been commenced. The cost of the building will be in the neighborhood of $65,000.

A large courthouse and land titles building will be erected at Humboldt by the provincial government, Messrs. Parsons Construction Company, of Regina, having been awarded the contract. The contract price is $79,990.

G. T. P. Hotel now under construction at Regina.

A thriving little municipality has sprung up on the very limits of Regina, and has assumed the name of North Regina. This action came as a result of the city's refusal to include this area within the city limits. As the population was large enough to apply for incorporation as a village, no time was lost in taking these steps. The Grand Trunk Pacific Railway shops are included in the territory of this new village which is arranging for the erection of municipal buildings and the installation of local improvement works.

The Engineering Society of Regina recently inspected the power house and investigated the system in operation there.

The new wing of the Regina General Hospital will be completed early in August, according to a report prepared for the hospital board.

Mr. L. A. Thornton, Works Commissioner of Regina, has prepared a detailed report dealing with the proposed nurses' home. The cost of this building will be $68,000.

Miscellanea

As the Canadian Northern Railway are unable to build their proposed station on Dorchester street, Montreal (from plans by Warren & Wetmore, New York), in time to deal with the traffic on the Mount Royal tunnel line, the directors will construct a depot on Lagauchetiere street. This will be used as an express depot when the Dorchester street building is erected.

The Canadian Pacific Railway will shortly have 1,095 miles of double track between Port Arthur and Calgary. This conveys some idea of the work involved in duplicating the whole system, which comprises some thirteen thousand miles of track. The double track will be built in a different way from the original railway. The present double track will offer a finished railway both as regards width of rails, strength of bridges and perfection of road-bed.

Messrs. Mills Bros., dealers in contractors' equipment, Toronto, have received an order from the Lake Shore Sand & Gravel Company, Limited, for their sand and gravel screening plant to be erected at Frenchman's Bay, Ont. The plant will consist of a bucket elevator with hopper and apron feeder, four screens (conical type, six feet long and set in pairs) driven by rope drive. Discharge will be handled through bottom gates in the three bins to belt conveyors. The capacity of the elevator and screens is 600 cu. yds. a day and the unloading conveyors will handle 300 cu. yds. an hour.

A new motor highway, which is claimed to be one of the finest ever laid down by motor road-builders, will be opened for traffic next October at Berlin, Germany. The road is six and a quarter miles long with parallel tarred macadam roadways, twenty-six feet wide and separated by grass plots of equal width. The work involved an outlay of over $500,000. It is designed essentially for speeding, and includes groves scientifically banked. The road will be finally opened as a race course in 1915, when an international contest for speed motoring will be arranged by the Imperial Automobile Club.

Enterprising arrangements are being made with a view to making a great success of the Fourth American Congress which is to be held in Atlanta, Georgia, from November 9-14 next. Entire streets are to be re-paved and roofed and thus turned into adjuncts to the large auditorium. Accommodation is to be provided for more than five thousand guests and arrangements have been completed for what will possibly be the largest government exhibit ever made. The Business Manager of the Congress is Mr. Chas. P. Light, who is now in Atlanta taking hold of the arrangements of exhibits and allotting space for the exhibitors.

A new railroad with Calgary, Alta., as one of its terminals is contemplated. The line is known as the Western Dominion R. R. It has been located from Calgary southerly to the South Fork of the Old Man River, thence southeasterly, via the towns of Pincher Creek and Cardston to the International boundary, near to the 23rd range west of the fourth meridian in southern Alberta. The length of the main line is approximately 201.2 miles. The company is not ready as yet to begin building, but probably will put a portion of the road under construction during the present season. The approximate quantities involved in the construction of the road include 3,636,069 cu. yds. of earth excavation; 106,501 cu. yds. of rock excavation; 3,568,980 cu. yds. embankment; 15,490 lin. ft. of trestles and 19,830 cu. yds. of masonry. Steel bridges will be constructed over all river crossings, with an approximate total length of 5,530 lin. ft. The bridge will be an equivalent of Coopers E50 specifications. Mr. J. N. Hayward Cornell, 29 Broadway, New York City, is chief engineer of the Western Dominion Railway.

Personal Mention

Mr. R. W. Brock, deputy minister of mines, Canada, is to devote part of the summer to a geological study of the Bulkley Valley, B.C.

Mr. William C. Rowse, M.E., who is a graduate of Purdue University, has been appointed professor of mechanical engineering in the University of Manitoba.

Mr. F. P. Adams

Mr. Frank P. Adams, City Engineer of Chatham, Ont., was born at Brantford in 1878. He was educated at Brantford and proceeded to the School of Practical Science in 1898. His earliest connection was with the Ontario Peat Development Company. For several years he was engaged in railroad and township surveying work. Then he became assistant engineer on the Grand Valley railroad. Later he went to Brantford as Assistant City Engineer and while there had charge of storm sewer and pavement work. He also designed a couple of reinforced concrete bridges at Brantford under the direction of Mr. T. Harry Jones, city engineer. (A description of these bridges has been published in this journal.) Mr. Adams was identified with Mr. Willis Chipman as assistant engineer on municipal work at Midland, Weston and Steelton. He was appointed City Engineer of Chatham some three years ago.

City Engineer Adams, of Chatham, Ont.

Mr. M. C. Hendry of Toronto, has been appointed chief engineer for the Manitoba Hydrographic Service of the Dominion. He has already taken up his duties in the new sphere.

Mr. S. H. Parsons has retired from the position of supervisor of buildings and purchaser of supplies for the Protestant Board of School Commissioners, Montreal. He is succeeded by Mr. E. B. Palmer.

Mr. C. F. J. Galloway, M.E., of the British Columbia Department of Mines, is at present investigating the mineral-bearing areas along the Grand Trunk Pacific Railway line, working east from Hazelton, B.C.

Mr. A. B. Garrow, who was for several years in the Toronto Main Drainage Department, has received an appointment with the Toronto Harbor Commission, and is in charge of the re-designing of the sewer outlets along the city's waterfront in connection with the harbor development scheme.

Mr. W. Hartley Patterson

Mr. W. Hartley Patterson, a member of City Engineer Rust's staff at Victoria, to whom the presentation of a service of plate was made recently on the occasion of his marriage (as recorded in the Contract Record of June 10) is a native of Ireland. He was educated in England and on the continent. In the early "nineties" he entered upon a five years' apprenticeship with Mr. W. H. Lynn, R.H.A., a prominent architect who has been actively engaged in the practice of his profession in Ireland for upwards of sixty years. Subsequently Mr. Patterson became associated with the firm of Graeme-Watt & Tulloch, architects and civil engineers, of Belfast. With this firm he made a special study of municipal and institutional architecture and in 1906 he was sent to Germany to obtain data on the planning and construction of asylums and hospitals. Coming to Canada in 1909, he settled in Victoria and became head draughtsman and designer for Messrs. G. C. Mesher & Company, with whom he was identified for upwards of two years. In the early summer of 1912 he joined the City Engineering Department at Victoria under Mr. C. H. Rust and is now occupied chiefly in the preparation of special structural plans and in drawing up specifications and details for the various departmental buildings. Mr. Patterson is a member of the Ulster Society of Architects and of the British Columbia Society of Architects. His new "partnership" is not without professional interest, for his marriage was to Miss Violet Woodhouse, daughter of the late Henry Woodhouse, C.E., of Stafford, Eng., for many years consulting engineer to the London & Northwestern Railway.

Mr. W. Hartley Patterson, Victoria.

Mr. Alfred S. Peene, who passed away a few days ago at Hamilton, Ont., was for many years one of that city's leading contractors. He was born in Kent, England, in 1830, and resided in Hamilton ever since his arrival in this country. He is survived by two sons, one of whom, Mr. A. W. Peene, is a well-known Hamilton architect.

Mr. Morgan Bransby Williams, who probably had more to do than any other man with the construction of the earlier railroads in the British Isles, died on June 22. He also planned and built many of the Italian railroads, as well as thousands of miles of Russian lines. He was born in 1825 in Wales, and after retiring from the engineering profession was for twenty years Vice-Chairman of the Metropolitan Bank of England in Wales.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

Port Arthur, Ont., city council has approved the estimates of the city engineer to expend $36,140 on improvements to Meikle Park.

York township council has been asked to consider bylaws for the issue of debentures amounting to $98,000 for structural alterations and additions to schools.

Canadian David E. Kennedy, Limited, were incorporated recently as contractors, engineers and dealers in contractors' supplies. The head office of the concern is at Montreal.

Some additional underground conduits are to be constructed in Montreal, the Quebec Public Utilities Commission having passed the plans for Notre Dame, McGill, Craig and St. James streets.

The London Builders' Exchange are making enterprising arrangements in connection with their fourth annual excursion, which is to be held at Toronto, July 11 next. The Secretary of the Forest City builders is Mr. F. S. Barclay.

The St. John, N.B., Board of Trade has received inquiries from a brick-making firm regarding the opportunities for the local of a brick-making plant in St. John. The matter is at the present receiving consideration from the civic authorities.

The new cathedral at Chicoutimi, the estimated cost of which is placed at $300,000, is nearing completion, the roofing work now being in progress. The architect is Mr. R. P. Lemay, and the general contractor, Mr. J. Giroux, both of Quebec.

The report of the Canada Brick Company, Montreal, states there was a loss from operations to December 31, 1913, of $8,524. This was due to the general slump in the building trade accompanying the financial depression throughout the Dominion.

A survey is at present being made on Wolf Island in connection with a tow road system which it is proposed to establish on that island in connection with the highway scheme. The survey is being carried out by an engineer of the Ontario Highway Commission.

Messrs. Jinchereau & Lamonde are the general contractors for a school building now in course of erection at Quebec. The building is four storeys high, of stone and Scotch brick construction, and will cost $200,000. Mr. R. R. Lemay, of Quebec, is the architect.

Mr. W. H. Wardwell, M.E., designing and contracting engineer, Montreal, has secured the contract for the reinforced concrete structure for the Molsons Bank, at the corner of St. Lawrence and Ontario streets, Montreal. Messrs. Turner & Carless, Montreal, are the architects.

The Day Building Company, Limited, has been incorporated with a capital of $40,000. The provisional directors are William John Cook, James Linklater, Harry J. Evans, George Edmond Buchanan and Miss Jessie McFeetors. The headquarters of the company is at Sudbury, Ont.

The Ambursen Hydraulic Construction Company, of Canada, Limited, Montreal, have been awarded the contract for Dam No. 1 of the Eugenia Falls Development on the Beaver River, Ont., for the Hydro-electric Power Commission. The structure will be two thousand feet long by fifty feet high and will be of the Ambursen type. The contract for No. 2 dam has been let to the firm of Hyland, Seriven & Whyte, of Belleville, Ont.

J. A. King & Company (Canada) Limited, has been incorporated with a capital stock of $150,000, as manufacturers of and dealers in fire-proof and other building materials and supplies; also to carry on the business of general contractors. The head office of the company will be at Montreal.

The Moncton, N.B., Board of Works, has planned an extensive street paving scheme to cost over $44,000 of the $50,000 appropriated by the city council for permanent street works. The estimate submitted by the city engineer provides for the use of bituminous material, macadam and tarvia.

Judge Beaudin has been appointed chairman of the board of conciliation in the dispute between the Montreal General Contractors' Association and the carpenters. The latter claim an advance of 2½c an hour and an eight-hour day. The association are also in negotiation with the bricklayers as to working conditions.

Works aggregating in cost forty-six million dollars are being started by the Public Works Department of the Dominion Government. The undertakings consist of harbor and river works, and public buildings. Work on the four-million-dollar departmental buildings in Ottawa is likely to be delayed considerably.

Messrs. Wilson, Townsend & Saunders, engineers and contractors, Toronto, have been awarded the contract for the construction of a 4-ft. 6-inch tunnel under the C. P. R. and C. N. R. right-of-way at Leaside, Ont. The tunnel will be approximately one thousand feet long, and will be of brick construction. It will be 40 to 45 feet underground, and will involve an outlay of some twenty thousand dollars.

Messrs. Rouly & Summers, civil engineers and contractors, Toronto, are engaged in carrying out an extensive scheme of road improvements in the County of Huntingdon, P.Q. Mr. T. J. Routly visited Quebec recently and interviewed the officials of the Road Department with regard to certain points in construction. The work forms part of the programme of road building and maintenance initiated by the Provincial Government.

The ratepayers of York township, Ont., are being asked by the Central Ratepayers' Association to consider a proposal submitted by a United States firm of engineers whereby the firm will construct a water works system in the township and guarantee a water supply to the residents at a fixed price per thousand cubic feet, the cost of construction to be borne entirely by the firm. It is proposed that the water be brought a distance of twenty-five miles.

A large number of grants for important constructional works have been secured for Hamilton during the last session of Parliament. Of the $620,000 voted for public works the most important single item was $250,000 for the work at Stipe's Inlet. This is part of a big scheme for harbor improvements, the plans for which have been worked out by the local Harbor Commission. Another important grant is that of $165,000 for the purchase of property and the starting of work on the new customs house and post office extension at the corner of Main and John streets. Other important items are the construction of the revetment wall and the reclamation of land in the vicinity; $50,000 for a wharf at the end of Wentworth street, and a grant of $40,000 for a new east end post office on Barton street.

Irregularities alleged by Chief City Engineer Janin, Montreal, to have been found in connection with sewer work by contractors in Notre Dame de Grace ward led the board of control a few days ago to decide on an official enquiry into the manner in which certain sewer contracts were carried out last summer. Pending the investigation between $50,000 and $60,000 of sewer contractors' guarantees on deposit will probably be held by the city.

The Excelsior Electric Manufacturing Company, Limited, has been incorporated with a capital of $40,000, to manufacture electric motors and to deal in electrical machinery of all kinds; also to purchase as a going concern the plant and machinery of the Excelsior Electric Manufacturing Company. The company's head office is at Toronto, and the provisional directors are Lewis Traver Rutledge, Newton Howard Manning, William E. Gorman, Ethel M. Rutledge and William M. Hall.

Three large building permits were taken out from the Toronto city architect's department on June 22. Wm. Croft & Sons, the smallware manufacturers, are to put up a six-storey brick warehouse on Wellington street west, near Spadina avenue, to cost $66,000. The Dominion Bank will build another branch on the corner of Logan avenue, at a cost of $22,000, and the Cosgrave Brewing Company will erect a brick and steel malthouse on Simcoe street, near St. Patrick street, at a cost of $15,000.

The National Contracting Company, Limited, with head office at Toronto, has been incorporated with a capital of $40,000, to acquire the business, goodwill, plant and machinery of the partnership carried on at Toronto, under the name of the National Contracting Company. The new company will continue the business of general contractors, and will also deal in contractors' and builders' machinery and supplies. The provisional directors are William Joseph Haynes, Frederick Reeves and William Myddleton Hall.

The Montreal Arena has made application to the Westmount city council for permission to establish an ice manufacturing plant on a site adjoining the Arena and fronting on St. Catherine street and Wood and Western avenues. The present intention is to operate the plant only in winter, for the purpose of insuring a perfect sheet of ice throughout the hockey season, irrespective of weather conditions. The plant will have a daily capacity of one hundred tons refrigeration. The work will be begun as soon as the permit is secured.

A ten-storey office building, to cost in the neighborhood of $300,000 is to be erected shortly on a site on the southwest corner of Terauley and Albert streets, Toronto, by Messrs. A. A. Barthelmes and Frederick Courtemanche, both of Toronto. The new structure will be of steel and brick construction, and will possibly have a wide terra cotta exterior. The property, which is now vacant, has fifty feet frontage on Teraulay street and a frontage of one hundred and sixty-four feet on Albert street. Construction work is expected to begin some time this month.

The controversy relating to the suggested Colborne street bridge to connect the King Edward Hotel with an annex which the company propose to erect, has resulted in the application being refused by the Toronto Works Committee on the recommendation of Commissioner Harris. Mr. E. J. Lennox, architect for the King Edward Hotel, appeared before the Works Committee and contended that the only possible enlargement of the hotel was across the street to the south of the existing building, and that the hotel people had planned to expend a million dollars on their annex.

In a time of comparative dullness it is gratifying to have Building Inspector McNamara, of Fort William, report to the Contract Record that the past month witnessed the busiest period of building ever experienced in the history of his city. The prevailing activity, he states, applies chiefly to dwellings costing $2,000 and over. On residential work, operations are being pushed forward aggressively in almost every section of the city. By the end of the present season it is estimated that there will be one thousand more dwellings in Fort William than there were a year ago. So far the building total is not ahead of last year, but this is owing to the conspicuous absence of permits for buildings of the larger type.

The North Toronto drainage system, recommended by Mr. R. C. Harris, Commissioner of Works, has been adopted by the city council of Toronto. The entire work is to cost $4,144,256, which includes provision for surface and domestic sewage. The Imhoff disposal system is to be used on the plant which will be erected in the vicinity of the upper valley of the Don River, and will be so constructed as to allow of future extension. The alternative scheme, adoption of which would incur an additional expenditure of about two and one-quarter million dollars, was also before the works department. The sewage disposal plans for divisions one and two will consist of stand-by tank for treatment of storm water, Imhoff tanks, chlorinating devices, sludge drying beds and sprinkling filters, or such other equipment as may be considered suitable. It is claimed that sewage passing through such a plant scientifically designed and constructed, will be inoffensive. The total estimated cost of plant number one for present requirements, including the site for future development, is $408,250, and for plant number two, $305,900. Of the total cost of the system and repairs, the ratepayers will assume about $1,362,311, while the city's share is estimated at $2,781,945.

WESTERN CANADA

The Arnold Art Stone Company, Limited, Winnipeg, Man., has been incorporated with a capital of $30,000.

At Calgary, a by-law to raise $300,000 for extensions to the electric light system has been approved by the ratepayers.

The British Columbia Water-Works Supplies, Limited, is a new company incorporated recently at Vancouver with a capital of $25,000.

The cost of building in Regina this year is said to be reduced considerably owing to willingness on the part of the contractors to accept small profits.

At Winnipeg, Man., plans have been filed with the board of control for the construction of a bridge over the Assiniboine River, at an estimated cost of $200,000.

At Vancouver, B.C., it is proposed to construct a concrete-lined tunnel from Burrard Inlet to the C. P. R. yards at False Creek. Plans are now being prepared for the railway.

At Saskatoon, foundation work is in progress on the Students' Residence in connection with the University of Alberta, which is being erected at an estimated cost of nearly $200,000. The architects are Messrs. Brown & Vallance, Montreal.

A noteworthy Winnipeg incorporation is that of the Metal Shingle and Siding Company of Manitoba, Limited. The new concern is capitalized at $500,000. The provisional directors include Messrs. N. J. Dineen, H. P. Grundy and F. W. Louthood.

Mr. Geo. Craig, city engineer, has made a recommendation to the city commissioners of Calgary, Alta., against the granting of a site to a company for the erection of a public mausoleum in the city, unless the company gives a guarantee for its maintenance.

An iron and steel manufacturing company has been anxious for some time past to secure a suitable location in the municipality of Burnaby, B.C., with a view to setting up an industry in the near future. The matter is at present receiving consideration by the secretary of the local Board of Trade.

Preliminary plans and estimates for the proposed Johnson street bridge at Victoria, B.C., have been completed by Mr. Rust, city engineer, and on completion of the final agreement, the terms of which have already been approved by the provincial government, the C. P. R., B. C. Electric Company, and the city council, the city will call for tenders for the construction of the bridge and prepare the necessary by-laws for providing $450,000, the estimated cost of the structure.

Moose Jaw, Sask., city council is thinking of acquiring a gravel pit with a view to obtaining gravel for macadamizing the principal residential streets of the city. In a report to the works committee, Mr. Geo. D. Mackie, city engineer, states that the cheapest method of securing good surfaces is by the use of some sort of macadam such as gravel screened, graded. In order to yield a satisfactory surface this would require to be treated with some patent road material such as rocmac.

Official announcement was made by Hon. George E. Foster recently that the Dominion Government had selected the site for the new Pacific coast government transfer elevator. It will be built on the site of the government drydock at Vancouver. Plans for the elevator will be prepared at once, although it will be two or three months before tenders can be let. It is expected that the elevator will be modelled largely on the plan of the government elevator at Port Arthur, though with possible changes to meet Pacific coast requirements.

There is a possibility that the bitulithic contracts let in 1912 for street paving at Vancouver, B.C., may be carried out this summer. The Columbia Bitulithic Paving Company is in communication with its eastern headquarters regarding a proposal to take bonds for the work. The contracts let for paving were Queen's avenue, from First street to Sixth street, $42,000; Fifth street from Third avenue to Sixth avenue, $42,000, and Sixth street from Fourth avenue to Sixth avenue, $19,000; additional charges for house connections, lights, depreciation of bonds, etc.

Canadian Railroad Development

Surveys are in progress for seven and one-half miles of street railway at Sudbury for the Sudbury & Copper Cliff Railway Company. The estimated cost is placed at $200,000.

Work on the extension of the Hydro-electric transmission line from St. Thomas to Windsor, Ont., has progressed so far that the engineers of the Commission hope that the line will be ready to deliver power to Windsor about the end of July.

Rapid progress is being made on the Alberta Central Branch of the C. P. R. west from Red Deer, Alta., and it is anticipated by the construction department that a regular service on this line will be established out of Red Deer during July.

Two parties of C. P. R. engineers and surveyors are working on the preparation of surveys to carry the line of the Esquimalt & Nanaimo Railway northward along the shore of Vancouver Island. One surveying party is working south of Campbell River and one north, the latter proceeding along the trail built by the government into the Salmon River Valley. It is surmised that the intention of the C. P. R. is to build eventually to the north end of Vancouver Island.

The Canadian Northern Railway Company expects to be able to obtain the two-million-dollars required for the completion of its transcontinental system from coast to coast. In the meantime the company is planning to go ahead with all its extensions and improvements. In a statement made a few days ago Sir Donald Mann, first vice-president of the company, announced that about a year hence the company expected to have all the various sections connected up and through trains from the Atlantic to the Pacific. The line along the north shore of Lake Superior is being pushed through rapidly, despite great engineering difficulties. In the west it is proposed this year to take up three hundred miles of light rails in the Edmonton Grand Bend section, and re-lay with heavy rails.

Trade Notes

The Link Belt Company, Chicago, has just issued "Section A of Catalog No. 110," which contains complete information on Detachable Link-Belt. This company was the first to introduce Detachable Link-Belt to the public and to-day it is its largest manufacturer. The book is well illustrated and covers a wide variety of stock.

The Merritt Hydraulics Company, 112 North Broad Street, Philadelphia, have published a particularly instructive book on Sewer Flushing containing an appendix on sewer pumping, sewer disposal and sewer jointing. The purpose of the authors has been to bring together the results of experience and experiment, and the statements of authorities regarding such important items as the conditions under which deposits will form in a sewer system and flushing will be needed, the amount of flushing water required, the effectiveness of a flush wave, and the frequency of flushing. The methods of flushing and their cost are detailed, and a number of pages are devoted to the theory and design of flush tanks and siphons. A description of the various types of Merritt Automatic and semi-Automatic Flush Tanks and a chapter on the selection of the Flush tank are also given.

The Ric-wiL Underground Pipe Covering Company of 666 New England Building, Cleveland, O., has just issued a new catalog of its underground conduits for steam pipes under the title of the "Ric-wiL Method." The "Ric-wiL" products are illustrated and described in detail, the most notable among these being perhaps the "Ric-wiL" vitrified tile conduit with patented interlocking base drain. This conduit consists of a salt-glazed vitrified tile, lined with a mineral insulation, the tile used being made from Akron shale thoroughly ground and mixed, free from foreign substances injurious to a first-class finished product, and which will withstand perfectly the heat necessary for vitrification. All the sections are salt-glazed, inside and out, and the process is so thorough that the tile is made absolutely waterproof. The inside surface of the tile is serrated or grooved to assist in holding the insulation in place. The insulating material inside the tile is a mixture, consisting mostly of Diatomite, sometimes called "infusorial earth," and used for insulation for the past fifty years in Europe, where it is known by the name of "Kieselguhr." Diatomite consists of microscopically minute forms of practically pure silica, made up chiefly of innumerable skeletons of diatoms containing air cells. When viewed under a powerful microscope it shows various-shaped minute hollow bodies, each one entrapping some air. which gives it its great insulating efficiency. The base drain is made of the same material as the conduit tile. The catalog contains much information of interest to heating men. It can be obtained from the manufacturers upon request.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Barton Twp., Ont.

Tenders have been called by the Twp. Council in connection with the construction of sidewalks at an estimated expenditure of $10,000. Bids will be received by Reeve, D. A. Gallagher, 16 James St. S., until noon, July 4th.

Fort William, Ont.

Tenders will be received by R. C. Desrochers, Sec. Dept. of Public Works, Ottawa, until 4 p.m., July 3rd, for widening existing channel of McKellar River to 50. ft., 172,405 cu. yds. of which 1 0,200 cu. yds. is reported to be clay, balance a glacial formation consisting of boulders, hardpan and cemented clay and gravel. Specifications at Dept., Ottawa, and at office of MacLean Daily Reports, Ltd., 220 King street W., Toronto. Work to be completed December 15th, 1914.

Humboldt, Sask.

The secretary-treasurer of the town council, Mr. W. T. Stiles, will receive tenders until 8 p.m., July 8th, for contract "T" in connection with the construction of sidewalks on 20 streets. Plans and specifications are at the office of the engineers, Chipman & Power, Canada Life Bldg., Winnipeg, and at Town Hall, Humboldt.

Hamilton, Ont.

The city council has postponed the proposed construction of an overflow sewer in the west end at an estimated cost of $8,260.

London, Ont.

Plans have been prepared by Engineer Wm. N. Ashplant for a concrete wall 14 ft. high to face embankment of gravel along bank of River Thames from Oxford to Dundas Streets.

Leamington, Ont.

The town council has decided to postpone the projected pavement work which will not likely be done until next year.

Montreal South, Que.

Tenders will be received by Henry Bennie, Sec.-Treas. municipal council, until July 4th, for concrete pavements on Victoria and Lafayette Aves. Specification is at the Town Hall, Montreal South.

Montreal, Que., St. Lambert

Tenders will be received by the town council until 6 p.m. July 6th, for installation of storm and sanitary sewers, street gulleys and manholes. Plans, etc., are at the office of the engineer, E. Drinkwater. Clerk, James R. Beatty.

Nanaimo, B.C.

The city council has recommended the laying of water mains on Comox Road, Haliburton, Grace, Cavan, Robins, Farquhar, Needham and Finlayson streets, at an estimated cost of $14,864. Mayor, A. E. Planta; Clerk, S. Gough.

The city council contemplate submitting a by-law upon which the ratepayers will vote on July 2nd for the extension of the sewerage system at an estimated cost of $30,000. Mayor, A. T. Planta. Clerk, S. Gough.

New Toronto, Ont.

Tenders will be received by G. D. Scott, clerk town council, until July 4th, for the laying of intake pipe. Plans and specifications are at the office of the engineers, James, Louden & Hertzberg, 79 Adelaide E., Toronto.

Ottawa, Ont.

The city council will call for tenders immediately for wood block pavements on various streets. City engineer, Arch. Currie, City Hall.

Orillia, Ont.

The town council (water, power and light commission) is calling for tenders for the construction of waterworks system at an estimated cost of $85,000. Tenders will be received by the secretary until 9 a.m., July 13th, for the following: laying watermains; construction of reinforced concrete circulating tank and pump house foundation; construction brick pump house; furnishing cast iron water pipe and specials; furnishing steel water pipe and specials; furnishing gate valves and hydrants; laying of intake pipe in Lake Couchiching. Tenders for the following will be received until 9 a.m., July 27th: furnishing and erection of motor driven turbine pumps and equipment; furnishing and erection of mechanical pressure type filtration plant. Plans, etc., are at the Commission Office, Orillia, after July 6th. Engineer, W. K. Greenwood, West Street.

Revelstoke, B.C.

The city council has passed a by-law providing for the construction of bitulithic pavements on 1st and MacKenzie Ave. Clerk, W. A. Gordon. City Engineer, A. F. Lundell.

Toronto, Ont.

The board of control has awarded contracts for sidewalks to the following firms: Standard Concrete Paving Co., 74 Moscow Ave.; A. Johnson, 35 Burgess Ave.; Wm. Bushell, 168 Dundas Street; W. E. Ransom, Dineen Bldg.; H. Mitchell, 464 Brock Ave.; A. Gardner & Co., 52 Strange Ave.; International Contractors, Ltd., 2261 Yonge St.; R. J. Moyes & Co., 592 Gerrard St. East.

Contracts for rubble stone have been awarded by the board of control as follows: F. Rogers Co., 1193 Queen W., $1.05 per ton, C. P. R.; Crushed Stone, Limited, Toronto Arcade, $1.17½ per ton, G. T. R.

Commr. of Works, R. C. Harris, has recommended as a local improvement the carrying out of a sewer system on Greenwood, Oakdene, Linsmore, Bathgate, Milverton, Glebeholme, Wolverleigh and Strathmore, at an estimated outlay of $31,000.

The city council has passed report of Commr. R. C. Harris for a sewer system for North Toronto and Moore Park with outlet in Don Valley, at an estimated cost of $4,144,256.

Tenders close July 7th with the Board of Control for the laying of asphalt on 8 streets, asphaltic concrete on 1 street, concrete curbings on 4 streets, and concrete walks on 26 streets. Plans are at the office of the Works Department.

Tenders have been called for the construction of concrete walks on Glenholme, Lauder, Day, Millerson Aves., and Jane Street, in York Twp., for which Frank Barber, 57 Adelaide St. E., is the engineer. Plans, specifications, etc., are at the office of the engineer, who will receive tenders until noon, July 6th.

Toronto, Ont. (Weston)

A new concrete filter bed may be added to the present waterworks plant at Weston, Ont., for the water, light and power commission. Clerk, J. H. Taylor.

Winnipeg, Man. (Charleswood)

A by-law has been carried in connection with the estimated expenditure of $60,900 on rural road improvements. Engineer, Highway Commissioner, Parliament Bldgs., Winnipeg.

Welland, Ont.

The town council invite tenders which will be received by the clerk, C. M. Webber, until 4 p.m. July 2nd, for approximately 6,200 sq. yds. vitrified brick, reinforced concrete or bitulithic, which is divided into 1,400 sq. yds. railway track construction and 4,800 sq. yds. side construction with curbs, etc. Plans and specifications are at offices of Town Engineer & Hugh C. MacLean, Ltd., 220 King St. W., Toronto.

CONTRACTS AWARDED

Brantford Twp., Ont.

The contract has been awarded to P. H. Secord & Sons, Ltd., Brantford, for the construction of 30,243 lin. ft. of sidewalks north of Grand River Canal, and 7,881 lin. ft. south of canal, at an approximate cost of $17,000. Clerk, J. A. Smith, Court House, Brantford. Engineer, Alan Muir Jackson, Room 4, Temple Bldg.

Montreal, Que., Verdun

The town council has awarded a $182,910 contract for paving at Verdun to Quinlan & Robertson, Ltd., 1680 St. Patrick St., Montreal. H. Hadley, Town Hall, Verdun, is the engineer.

New Toronto, Ont.

The town council has awarded the following contracts for waterworks construction: Mains, hydrants and valves, Canadian Allis-Chalmers Co., 212 King W., Toronto, $11,841; steel tank with tower, Chicago Bridge Co., Bridgeburg, Ont., capacity 75,000 gals., $4,450; 18-in. steel intake pipe, Thor Ironworks Co., Foot of Bathurst St., at $2.25 per ft.; laying mains, E. J. Hartnett, 17 Lumbervale Ave. Council not ready to call for tenders for pump house or pumps. Clerk, G. D. Scott. Engineers, James, Louden & Hertzberg, 79 Adelaide E., Toronto.

St. John, N.B.

The contract has been awarded by the city council to Jno. Birch & Co.. London, Ont., for cast iron pipes ranging from 4 in. to 12 in.

The city council has awarded the contract for the construction of brick and concrete sewers at a cost of $6,065 to Tobias, Corey, Stevens & Stevens, St. John.

Toronto, Ont.

Contracts have been awarded by the board of control for grading as follows: Oakcrest Ave. E., Provincial Contracting Co., 5 Dineen Bldg.; Williard Ave., Britnell Contracting Co., 209 Davenport Road; Oakcrest Ave. W., Iona Ave., Patricia Drive, B. F. Law, 143 Kingston Road; curbings on Glenholme to Grant Contracting Co., 50 Front St. E.

The Board of Control has awarded the following pavement contracts to the Commr. of Works: asphalt on Eastmount, Greenville and Tyrrel; bitulithic on Ashworth, Bracondale, Conrad, Frank Cres., Hillcrest Drive, Melita and Silver Birch; concrete on St. Mathias Place, concrete sidewalk on Cunningham St., Rochester, Spadina Rd. and Strathgowan.

Winnipeg, Man.

The tender of H. Galbraith has been accepted by the board of control for the construction of granolithic sidewalks on Maryland St., at $1,556.64, and Langside St., $1,044.66. Sec., M. Peterson, engineer, W. P. Brereton, 223 James Ave.

The board of control has awarded a contract to H. Galbraith for the construction of a 25 ft. asphalt pavement on Notre Dame Ave., at a cost of $9,285.95, including binder and surface. Sec., M. Peterson, engineer, W. P. Brereton.

A contract has also been awarded by the board of control for sewers in Woodrow Place, at $503, Garfield St.. at $925.50 and Young St.. at $966, to J. W. Astley, Engineer of Construction, City Yards. Sec., M. Peterson, engineer W. P. Brereton, 223 James Ave.

Railroads, Bridges and Wharves

Aldborough Twp., Ont.

Tenders will be received by E. A. Hugill, Rodney P.O.. clerk township council, until 6 p.m. July 4th, for the construction of 4 bridges. The plans are at the office of the clerk.

British Columbia

The Grand Trunk Pacific Railway has authorized the construction of five bridges in B. C. across Shames River, Hardscrabble Creek and Sand Creek. The Board of Railway Commissioners has authorized the reconstruction of a bridge on the C. P. Ry. tracks at Grand Forks, B.C. The construction of four bridges in British Columbia across Porcupine Creek, Fiddler Creek, Lorne Creek and Kitwanger Creek, has been authorized by the G. T. P. Railway. The Grank Trunk & Canadian Pacific Railways are to construct spurs for the Inland Lumber & Building Company at Winton; the Canmore Coal Company, Canmore; and the Alsip Brick & Supply Company, Limited. Nelson & Port Sheppard Railway Company has decided to construct a spur into the premises of the Benton Coal & Timber Company, five miles west of Erie, West Kootenay District, B.C. The Esquimalt & Nanaimo Railway are to construct a siding for Spragge & Company, west of Victoria, B.C.

Castor, Alta.

The town council contemplate purchasing (1) 6-in. piping, (2) 12,000 gallon tank, (3) suitable pumping engine, for the purposes of fire equipment. Mayor, Geo. M. Dillon, secretary-treasurer, L. B. Brown.

Ottawa, Ont.

The Morrisburg & Ottawa Electric Railway will receive tenders until July 4th for the construction, equipment and right of way of its line of railway from Ottawa to Chesterville, Ont. (35 miles). Plans are at the office of the engineer, L. VonSydow, Union Bank Bldg.

Province of Ontario

The Grand Trunk Railway is constructing sidings into the premises of Elias Rogers Company, Limited, Toronto; the United Drug Company, Limited, Toronto; Siemon Brothers, Limited, Wiarton, Ont.; Sarnia Bridge Company, Limited, and John R. Booth, Nipissing, Ont.

Province of Saskatchewan

Tenders are called by the Provincial Government, Board of Highway Commissioners, for the following bridge construction: one 16-ft. standard pile bridge, approximately 280 cu. yds. grade; one 20-ft. standard pile bridge, approximately 60 cu. yds. grade; one 20-ft. standard pile bridge approximately 400 cu. yds. grade; one 20-ft. standard pile bridge, approximately 80 cu. yds. grade; one 16-ft. standard pile bridge, approximately 240 cu. yds. grade. Tenders to submit prices for each individual work, contract to be awarded on total of these prices. Commission prefers awarding contracts in groups, provided prices submitted are satisfactory. Plans, etc., are at office of Chairman, F. J. Robinson, Regina, who will receive tenders until July 11th.

Sherbrooke, Que.

Tenders will be received by E. C. Gatien, Sec., City Council, until July 3rd, for repairs to the bridge over the St. Francis River, at Bridge St., consisting of strengthening by steel girders, and renewing the flooring with creosoted blocks, according to plans and specifications at the office of the engineer, W. Chase Thomson, C.E., 10 Cathcart St., Montreal and city engineer. Work is to be completed by September 1st.

St. Paul de Chester, Que.

Tenders will be received until July 6th by Geo. Roberge, Sec.-Treas., municipal council, for the construction of an iron bridge with concrete abutments. Plans, etc., are at the office of the Sec.-Treas.

Scotstown, Que.

The municipal council are contemplating the construction of a bridge across the Salmon River. Mayor, Mr. McKenzie.

Ste. Clothilde, Que.

Plans are prepared for the erection of an iron bridge for the municipal council. Plans and specifications are with Mr. P. Primeau; further information from Mayor, Emile Caille.

Toronto, Ont.

Tenders will be received by A. J. McGee, 25 Toronto St., Sec.-Treas. Temiskaming & Northern Ontario Rly. Commission, until noon July 6th, for supplying and installing a hot water heating system in each of 3 standard No. 2 stations now being erected on line of railway. Plans, etc., are at the offices of the Sec.-Treas. and the Chief Engineer, North Bay.

The University of Toronto has awarded the contract for a tunnel 275 ft. long, excavation out, to Toms Contracting Co., 56 Spencer Ave. Supt., Graham Campbell.

CONTRACTS AWARDED

Elgin, Ont.

Plans are being prepared by the county council for the erection of 4 iron and cement bridges to be constructed in Dunwich and Aldborough Townships. Clerk, K. W. McKay, St. Thomas; engineers, J. A. Bell & Son, Court House, St. Thomas.

Langenburg, Sask.

The contract for the construction of a sluiceway, etc., at an estimated cost of $8,000, has been awarded by the Prov. Govt. Board of Highway Commrs., to Parsons Constr. & Engineering Co., Ltd., 1712 Scarth St., Regina. Reinforced concrete construction will be used.

Lang, Sask.

The general contract for the construction of 2 reinforced concrete bridge abutments over Moose Jaw Creek, near Lang, at a cost of $10,000, has been awarded by the Highway Commrs. to Parsons Constr. & Engineering Co., Ltd., 1712 Scarth St., Regina.

London, Ont.

A committee of the board of control has been appointed to investigate the contemplated construction of a subway under the G. T. R. tracks at Ridout St. Mayor, C. M. R. Graham. Engineer, Wm. N. Ashplant, City Hall.

Montreal, Que.

Tenders will be received by L. N. Senecal, Sec., Board of City Commrs. (Elec. Commsn.), until noon July 10th, for the construction of a system of underground conduits, main and service manholes, transformer chambers, etc., according to plans at the offices of the Elec. Commsn., 1009 New Birks Bldg. Chairman Commsn., L. A. Herdt.

Metcalfe Twp., Ont.

The township council has awarded the contract for concrete work to R. Waltham, c/o Harry Thompson, Glencoe, Ont., and for steel to the Hamilton Bridge Works Co., Ltd., in connection with the construction of a bridge.

McTaggart, Sask.

The general contract has been awarded by the Prov. Govt. Board of Highway Commrs. to Parsons Constr. & Engineering, Co., Ltd., 1712 Scarth St., Regina, for the construction of a reinforced concrete bridge and dam, at an estimated cost of $8,000.

Parkhill, Ont.

Contracts have been awarded for the construction of 2 bridges, each one span 60 ft. long, concrete and steel construction as follows: Concrete work, R. Waltham, Kerrwood, Ont.; iron, David Witherspoon, c/o Clerk, T. C. Robson, County Bldgs., London. Engineer-in-charge, C. Talbot, County Bldgs., London.

The contract has been awarded to John Ritchie, Beamsville, Ont., for the construction of a concrete bridge (Brown's bridge) near Schomberg, for the counties of York and Simcoe. Engineer, F. Barber, 57 Adelaide E., Toronto.

Public Buildings, Churches, Schools, etc.

Brighton, Ont.

Tenders will close with E. C. Brown, Sec., and Ellis & Connery, Manning Chmbrs., Toronto, architects, on July 4, for the erection of a 12-roomed, brick construction, school for the School Board.

Cobalt, Ont.

Tenders will be received by Jno. Leigh, Sec., Public School Board, for school alterations estimated to cost $5,000. Steel construction will be adopted. Architects, Angus & Angus, North Bay.

Cranbrook, Ont.

The Presbyterian Church Congregation of Cranbrook, Ont., are selecting an architect to design a $10,000 church.

Edmonton, Alta.

Tenders will be called in about a week in connection with the construction of an Anglican church on Kinistino and Short Sts. The plans are in progress. Architects, Barnes & Gibbs, Imperial Bank Bldg.

Emard, Que.

Tenders will be received at 199 Monk Blvd., until July 4th, for the construction of a church for the Church Trustees. Plans are at the office of the architect, H. Bergeron, Longue Pointe, Que.

Grimsby, Ont.

Tenders will be received by R. C. Desrochers, Ottawa, Secretary Dept. Public Works, until 4 p.m., July 7th, for post office interior fittings. Plans, etc., are at the office of Thos. A. Hastings, Clerk of Works, Postal Station "F," Toronto, K. N. Grout, Clerk of Works, Grimsby, and at Department, Ottawa.

Hull, Que.

Plans will not be prepared until the Fall in connection with the contemplated construction of a $75,000 church for the St. Redempteur Church, c/o O. M. I. Archbishop of Que., Most Rev. Mgr. L. N. Begin, D.D.

Jonquieres, Que.

The Dominion Government, Department of Public Works, has awarded the contract for a post office on St. Thomas and St. Dominique streets to Marois & Girard, Jonquieres.

Lethbridge, Alta.

The Anglican Church Congregation has had plans prepared for the construction of a church, hall and rectory at an estimated cost of $150,000. Clemesha & Portnall, Credit Foncier Building, Regina, are the architects.

London, Ont.

Plans are in progress for a $15,000 auditorium to be erected on Dundas St., for the Redemptorist Fathers, Dundas St. E. (Father Doyle). Architects, Watt & Blackwell, Bank of Toronto Bldg.

Medicine Hat, Alta.

Tenders will be received until 5 p.m. July 6th, by James L. McCallum, Sec., Public School Board, for the construction of a primary school on Montreal St. Plans, etc., are at the office of the architects, McCoy & Levine Engineering Co., Huckvale Block.

Moncton, N.B.

Tenders will be received until July 4 by Rev. Fr. Savage, Botsford St., for the construction of a $30,000 Presbytery on Botsford and Queen. Plans and specifications are with Fr. Savage and at the office of the architect, R. A. Frecht, 30 Bonnacord St.

Montreal, Que.

Tenders for the construction of a church on Dorchester W., for St. George's Parish, will be received by the architects, Barott, Blackader & Webster, New Birks Bldg., until July 2nd.

The architect, H. C. Stone, 84 St. Francois Xavier Street, is receiving tenders on several sub trades in connection with the expenditure of $40,000 on renovating St. James' Club, Dorchester and University Streets.

Montreal, Que., Victoriatown

Tenders are invited by L. J. T. Decary, News Birks Bldg., Montreal, architect, for the general contract in connection with $5,000 alterations to a convent for St. Alphons School.

Montreal, Que., Verdun

Plans are in progress in connection with the proposed erection of a $20,000 club house at Verdun for Verdun Athletic Club. Pres., Wm. Evely, 444 Bleury St. Architect, D. J. Spence, 46 Beaver Hall Hill.

Montreal, Que. (Maisonneuve)

Plans are in progress for the construction of a $70,000 fire and police station for the town council on Letourneau and Notre Dame. Marius Dufresne, Ontario street, Maisonneuve, are the architects.

Nanaimo, B.C.

Tenders close with J. E. Griffin, Victoria, B.C., Deputy Minister of Public Works, on July 6th, for the construction of a building for Harewood School Board. Plans, etc., are with W. H. Jones, Sec. of Board; J. Mahony, Court House, Vancouver; Geo. Thompson, Govt. Agent, Nanaimo, and at Dept., Victoria.

Point Grey, B.C.

Tenders will be received by the architects, Sharp & Thompson, London Bldg., Vancouver, until noon, Aug. 5th, for the construction of a Science Bldg., first unit of University group, three storeys, reinforced concrete construction, for the Department of Education. Plans and specifications are at the architect's office and Builders' Exchange, Duncan Bldg., Vancouver.

Port Robinson, Ont.

Plans are in progress for the erection of a Guild Hall at an estimated cost of $5,000 for St. Paul's Church. D. F. Forbes, Temple Bldg., Welland, is the architect.

Sussex, N.B.

The Provincial Government, Department of Agriculture, has called for tenders in connection with the construction of a $25,000 agricultural college. Architect, G. Ernest Fairweather, 84 Germain Street, St. John. Plans and specifications are at office of the Department, Fredericton, and at the offise of the architect, St. John, and Hon. J. A. Murray, Minister of Agriculture, Sussex, who will receive tenders until noon, July 9th. The building will be two storeys, concrete foundation, weatherproofed, brick construction, felt and gravel roofing, etc.

Sandwich, Ont.

Plans are in progress in connection with the erection of a fire hall at an estimated cost of $10,000 for the expenditure of which the ratepayers will shortly vote on by-law. Clerk, T. R. North.

Sturgeon, P.E.I.

Tenders are called and will be received by Theo. Gallant, Parish Priest, until July 9th, for the erection of a parish hall. Plans and specifications can be seen at the parochial residence.

Summerside, P.E.I.

The site has been purchased on Summer and Fitzroy streets for a contemplated civic building for the town council. Clerk, H. J. Massy.

St. John, N.B.

Plans are in progress in connection with the contemplated construction of a banqueting hall, assembly lodge rooms and offices on Chipman Hill, for the Knights of Pythias. Sec. Bldg. Com., C. P. Nixon, Canterbury St., architect, Garnet Wilson, 50 Princess St. Building will be 3-storeys, 45 x 100.

Timmins, Ont.

Contracts will be awarded shortly for the construction of a $15,000 church for the R. C. Congregation. Architect, J. O. Turgeon, 55 St. Francois Xavier St.

Truax, Sask.

Truax School District No. 2849 has not accepted the tenders for a school building on the ground that they were too high. Sec.-treas., Reg. Cummings, Truax.

Toronto, Ont.

Tenders are invited by the architects, Burke, Horwood & White, Ryrie Bldg., for the construction of a Sunday school for Danforth Ave. Methodist Church. Building will be brick construction.

Toronto, Ont. (Mimico)

Tenders close with the architect, S. B. Coon & Son, 409 Ryrie Bldg., Toronto, July 11th, for the construction of a $10,000 library on Station and Stanley streets, for the Public Library Board. Plans are with the architect and F. A. Werden, Post Office, Mimico.

Victoria, B.C.

Plans have been accepted and tenders will be called shortly for the construction of a $7,500 building for the Seamen's Institute. Architect, J. C. M. Keith, 416 Sayward Bldg.

The Dominion Government, Public Works Department, are having plans prepared for the erection of a $250,000 postal station "B" on Gore Ave and Keefer street. Secretary, R. C. Desrochers, Ottawa.

South Vancouver, B.C.

A site has been secured and plans are

in course of preparation for the construction of a $35,000 Post Office on Main street and 43rd Ave for the Dominion Government, Department of Public Works, the secretary of which is R. C. Desrochers, Ottawa.

Winnipeg, Man.

St. Andrews Presbyterian Church, Elgin, have decided not to proceed with church building at River Heights this year.

Option has been taken on a site for a contemplated hall and lodge room, on Donald and Graham Sts., at an estimated cost of $75,000, for the Ancient Order of Foresters. Chief Ranger, Theo. E. Howard, c/o Gaults, Ltd.

Wallaceburg, Ont.

The contract has been awarded to T. H. Cade for the erection of a $7,000 Sunday school for Knox Church Congregation. Architect, R. W. Fawcett, 152 Essex Street, Sarnia, Ont.

CONTRACTS AWARDED

Alvinston, Ont.

The contract for the construction of a church and sheds on River St., at a cost of $12,000, has been awarded to D. J. McEachern, Elgin St. Building will be 2-storeys, 54 x 50, red brick construction. Sec. Bldg. Com., P. A. McDiarmid. Architect, W. G. Murray, Dominion Savings Bldg., London.

Hensall, Ont.

The contract for the construction of a town hall at an estimated cost of $6,500 has been awarded to S. S. Cooper for the town council.

Kintore, Ont.

The contract to erect a church at a cost of $7,000, for the Presbyterian Church Congregation, has been awarded to W. Leslie, Church St., St. Mary's, Ont. Architect, W. G. Murray, Greene Swift Bldg., London.

Midland, Ont.

The contract has been awarded by the Dominion Government, Department of Public Works, to the Berlin Interior Hardware Co., Ltd., Berlin, Ont., for the supply of Post Office fittings.

Nepean Twp., Ont.

The general contract has been given to N. Poirier & Son, 193 Cathcart St., Ottawa, for the construction of a $18,000 school at Springhurst, for the R. C. Denomination and Sisters of the Sacred Heart, 1 Main St., Ottawa.

Ottawa, Ont.

The following contracts have been awarded in connection with alterations to Knox Presbyterian Church, Albert St.: Masonry, Chas. Holbrook & Son, 425 Somerset; carpentry, Cuthbertson & Clark, Hawthorne Ave. . Heating not let. The architect is J. P. MacLaren, 104 Sparks St.

Sanford, Man.

The general contract has been awarded to C. Perron, Letellier P. O., Man., for the construction of a $10,000 school for Sanford School Dist. E. D. Tuttle, McArthur Bldg., Winnipeg, is the architect.

St. Agathe des Monts, Que.

The Dom. Govt. Dept. of Public Works has awarded the contract for the construction of a new post office, to J. A. & R. Grou, St. Laurent, Que. The architects of the building, which will be brick construction, steel columns and girders, are Finlay & Gagnon, New Birks Bldg., Montreal.

Toronto, Ont.

The Board of Education has awarded the following contracts for miscellaneous school work: iron stairs at Eglinton school, W. D. Beath & Son, Ltd., 80 Cooper Avenue, $1,800; roofing and galvanized iron at Sackville Street School, D. M. Rowe & Co., 154 Euclid Ave., $147; painting, Duke, Joseph, Workman and Rose Ave., R. G. Johnston, 17 Galley Ave., $495; painting Morse Street, Joseph R. Bell, 160 Clinton street, $172; painting Jarvis Collegiate Institute, R. A. Rawlinson, 462 Pape Ave., $364.

Winnipeg, Man.

The contract has been awarded to Gray & Davidson, Arlington Street, for the construction of a $15,000 Church on Horne Street and Wellington Ave., for St. Jude's Congregation. 40 x 116, brick construction, stone foundation, shingle roofing, electric lighting, hot air heating. Architect, H. W. Greene, McGreevy Block.

Business Buildings and Industrial Plants

Bassano, Alta.

Tenders will be received by R. C. Desrochers, Sec., Dept. of Public Works, Ottawa, until 4 p.m. July 22nd, for the construction of a post office and customs house. Plans, etc., are at the office of Mr. Leo. Dowler, architect, Calgary, at Post Office, Bassano, and at Dept., Ottawa.

Brantford, Ont.

An architect is to be appointed shortly to design a glue factory for the Canada Glue Co. Managing director, Paul Kreisman, 44 William St. Asst. manager, W. J. Feldkamp, 133 Sheridan St.

Tenders will be received until July 4, by W. J. Carmichaell, c/o Bell Telephone Co. of Canada, for extension to telephone exchange, at an estimated outlay of $7,000.

Brockville, Ont.

A planing mill owned by Briggs Planing Mill Company has been destroyed by fire, and the loss is estimated at $20,000.

Chatham, Ont.

Work postponed undefinitely on the contemplated erection of a store and pool room, at an estimated cost of $10,000, for Bates Bros., 24 William St. S.

The city council contemplates the installation of an electric lighting system along the river bank. Mayor, Jno. McCorvie; clerk, W. G. Merritt.

Edmonton, Alta.

Tenders for the superstructure of stores and offices on First St., for Adam Bros., 653 3rd St., will be called shortly. Building will be -storeys and basement, brick construction, concrete foundation, waterproofed, etc. Four storeys only to be built at present. Architects, Barnes & Gibbs, Imperial Bank Bldg.

Plans are in progress for the construction of a business block on 2nd St. for Geo. Roberts & Sons, 209 C. P. R. Bldg. Architect, A. W. Cowley, Agency Bldg. Tenders will be caller shortly.

Hamilton, Ont.

An addition to ice cream factory at an estimated cost of $10,000 is contemplated by L. O. Buist, 93 Emerald St. S. The building will be brick construction, concrete foundation, felt and gravel roofing, electric lighting, concrete floors.

The projected building of a theatre on James St. N., for the Princess Theatre has been abandoned for the present.

London, Ont.

The contract for $15,000 addition to factory for McClary Mfg. Co. on Adelaide Street has been awarded to R. J. Insell, Waterloo Street South.

The contract has been awarded to J. Putherbough, 1006 Wellington Street, for addition to factory on Richmond Street at a cost of $6,500 for London Free Press Printing Co., Ltd., Richmond Street. Architect, J. M. Moore, 435½ Richmond Street.

Equipment will be required in connection with a projected extension to a glass factory for Forest City Glass Co., 74 Fullarton St.

Machinery is required by A. A. Langford Co., 425 Richmond St., in connection with their contemplated $40,000 stationary factory on York and Wellington.

Milton, Ont.

Tenders close with the architects, Geo. N. Molesworth and Gordon M. West, No. 2 College street, Toronto, on July 6th for the contract for the construction of a registry office, one storey and basement. 40 x 50, stone and brick construction, reinforced concrete, fireproof, slate or tile roofing, etc., for the Halton county council. Chairman of Com., A. S. Forster, Oakville, Ont.

Montreal, Que.

It is undecided as yet whether the contemplated extension to the Children's Memorial Hospital, Cedar Ave., at an estimated expenditure of $25,000, will take place. Tenders are all in.

The contract will be awarded shortly for the construction of a $50,000 picture theatre on St. Lawrence and Ontario Sts. L. A. Amos, 78 Crescent St., is the architect.

It is not likely that the contemplated $50,000 theatre for Mr. Bastein and Mr. Back, Montcalm and St. Catherine Sts., will be erected this year.

Contracts will be let shortly for painting and electric work in connection with the construction of a $9,000 boiler house on Richmond for the Toilet Laundry Co., Ltd., 425 Richmond St. General contractors, A. F. Byers & Co., 340 University; heating and plumbing, W. J. Graham, 85 Cathcart St. Architects, Hutchison, Wood & Miller, Royal Ins. Bldg.

Tenders will be called immediately by S. Vineberg, 316 Notre Dame W., for painting of new theatre on St. Lawrence and Duluth. Architect, C. Dufort, 192 St. Catherine W.

Montreal, Que. (Outremont)

Plans are drawn in connection with the contemplated construction of a fire station for the town council, but it is not yet decided whether building will be carried out this year. Clerk, E. T. Sampson; architect, J. Duchastel, town hall, Outremont.

Montreal, Que., Lachine

Tenders will be invited by H. Cahrette, Sec., Town Council, Lachine, for the erection of a $15,000 fire station to be put up this summer. Benoit & Girard, Southam Bldg., Montreal, are the architects.

Niagara Falls, Ont.

Plans are in course of preparation for the erection of a store and office building on Queen and Ontario Sts., for the I. O. O. F. Tenders are now being received for the removal of old buildings. Chairman of Bldg Com., Postmaster Wm. Phemister. Architects, Bond & Smith, 15 Wilton Ave., Toronto. Building will be 4-storeys, 107 x 50, steam heating plant, elevator.

Ottawa, Ont.

The stores, bakery, etc., on Murray St., have been destroyed by fire, involving a loss of $12,000. Owners, E. Renaud, Murray St.; B. Applebaum, tinsmith shop, loss on machinery $2,000; Ottawa Bottle Trading Co. Insurance small.

Richmond, Que.

Plans are in progress for extensions to the factory of the Boston Last Co., Main street.

Regina, Sask.

A syndicate is at present experimenting with Regina clay and if successful a plant will be erected with a capacity of 40,000 bricks.

The contract has been awarded in connection with the construction of a $6,000 warehouse for the Metal Shingle & Siding Co., Ltd., to McDiarmid & Donelly, 1713 Scarth Street. Architect, Tripp & Rowley, 509 Canada Life Bldg.

The general contract to build a $10,000 residence on Lakeview for J. E. Doerr, F. Crescent Apts., has been awarded to A. W. McGregor, 8 Masonic Temple. Architect, R. N. Darrach, Western Trust Bldg.

Poole & Emery, Moose Jaw, have been awarded the general contract for a $75,000 office building to be erected at 12th Ave. and Smith street for the Saskatchewan Co-operative Elevator Co., Ltd. Architects, Storey & Van Egmond, 1013 McCallum Hill Bldg.

Application has been made to the city council for the city to erect a $15,000 broom factory and sell to the Western Broom Company on easy terms. N. R. Darrach, Western Trust Bldg., is the architect.

Tenders will be called shortly for the erection of the Empress theatre for W. Milne, 2267 Smith St., at an estimated cost of $65,000. Architects, Tripp & Rowley, 51 Canada Life Bldg. Building will be 3-storeys, 50 x 125, ornamental stone, brick and terra cotta construction.

St. Johns, Que.

Tenders are in and contracts will be awarded shortly for the construction of a factory for Can. Hart Accumulator Co., London, Eng. Septimus Warwick, F.R.I.B.A., Guarantee Bldg, Montreal, is the architect.

Sarnia, Ont.

The construction of a $20,000 iron foundry on Clifford for Mueller Brass Works is contemplated. The building will likely be of white brick construction.

Scotstown, Que.

The town council is calling for tenders for the erection of a pump house. Tenders will be received by Mayor McKenzie, Scotstown.

Sherbrooke, Que.

Tenders are being received by the architect, T. R. Peacock, St. Peter St., Que., for the erection of a shoe factory for J. H. Hamilton, Levis, Que. The building will be 4-storeys, 125 x 30, concrete foundation, mill construction, felt and gravel roofing, etc.

Toronto, Ont.

Plans have been drawn in connection with the building of a garage on College near Dufferin, for J. Becker, 265 Gladstone Ave., who will buy material and supervise construction. J. A. Harvey, 164 Bay St., is the architect.

Vancouver, B.C.

Tenders will be received by the Director of Contracts, Ottawa, until noon July 13th, for the construction of a 2-8 target rifle range. Plans, etc., are at the office of the officer commanding military district No. 11, Victoria, B.C., City Clerk, Vancouver, and Director General of Engineer Services, Headquarters, Ottawa.

A permit has been issued for the erection of an $8,575 fire hall on 22nd Ave. and Nootka street for the city council. Clerk, Wm. McQueen; general contractor, A. L. Ramage, 1350 6th E.

A permit has been issued for the erection of $11,000 stores on 9-21 Hastings St. E., for C. Dawson, 1274 Barclay St. Gray Bros., 402 Pender St. W., are the architects and general contractors.

Windsor, Ont.

Tenders are being received for the construction of a warehouse and barns at an estimated cost of $4,700, for Geo. E. White & Son.

Winnipeg, Man.

Plans are in progress for the construction of public baths at Cornish Park for the board of control. Secretary, M. Peterson. Architect, D. W. F. Nicholls, Somerset Bldg.

Yorkton, Sask.

Equipment is required for work on a fire hall for the town council. Clerk, F. I. Pilkington.

Tenders are to be called in connection with the erection of a cooling plant for new electric power house for the town council, the Clerk of which is F. I. Pilkington.

CONTRACTS AWARDED

Berthier, Que.

The general contract for the construction of a distillery for Milcher Gin Co., has been awarded to Mr. Chenard, Berthier. Architects, Saxe & Archibald, Beaver Hall Hill, Montreal.

Montreal, Que.

The following contracts have been awarded in connection with the construction of an $8,000 warehouse on St. Thomas, for A. C. Leslie & Co., Ltd., 560 St. Paul St. General contractors, Murray & McRitchie, 20 St. Nicholas; steel, Dom. Bridge Co., Lachine; roofing, Geo. W. Reed & Co., 37 St. Antoine; heating and plumbing, Selkirk Bros., 2308 Waverley St.

The general contract for the erection of a boiler house at a cost of $5,000, has been awarded to Raymond Constr. Co., Ltd., Unity Bldg. The steel contract has been given to the Dom. Bridge Co., Lachine; roofing, Sibley & Huot, 34 St. Martin. The general contractor will do all other trades.

North Sydney, N.S.

The general contract for the construction of a warehouse on the waterfront, at a cost of $5,000, has been given to F. C. Redding. Building will be 2-storeys, concrete foundation, reinforced concrete construction, electric lighting, concrete floors, freight elevator.

Prince Albert, Sask.

The contract for the supply of material and construction of a new telephone system has been awarded by the Colleston Rural Telephone Co. to the Prince Albert Electric Co., 108 8th St. E. Sec.-Treas., Andrew Knox, P. O. Box 333, P.A.

Sandwich, Ont.

The general contract has been awarded to the Canadian Home Constr. Co., Windsor, for alterations to the Essex County Golf Club, R. W. Morton, Windsor, at an estimated cost of $5,000. Donald Smith, Walkerville, is the architect.

Strassburg, Sask.

The general contract has been awarded to Winnipeg Engineering Co., 46 Canada Life Bldg., Winnipeg, for the supply of material and construction of a telephone system, at a cost of $6,575 for East Mt. Royal Telephone Co., Ltd., Sec., V. G. Watkin, Strassburg.

Toronto, Ont.

The following contracts have been let in connection with the construction of a livery and paint shop on 16 Hayden street for Maher Livery Co., 19 Bloor St. E. Masonry, Nurse & Son, 9 Salisbury Ave.; carpentry, Mr. Livingstone, 344 Don Mills Road; steel, Reid & Brown, Esplanade E.; roofing, Canadian Johns-Manville Co., 19 Front E.; plumbing, Robt. Locke, 713 Yonge St. N. G. Beggs, Cosgrave Bldg., is the architect.

Vancouver, B.C.

The contract has been awarded for the construction of a $15,000 warehouse on Water street to Copp & Kilgren, 1840 Scott street, who will receive tenders for sub trades.

Winnipeg, Man.

The contract has been awarded to Frid Lewis & Co., Somerset Bldg., for the reconstruction of an office building on Main Street, in hollow tile and reinforced concrete. Owner, F. W. Scott, 190 Kingsway; Architects, Pratt & Ross, Electric Railway Chambers.

Canadian Westinghouse Co., Ltd., Portage Ave. E., has been given the contract for the installation of two 3-phase self-starting synchronous condensers at $52,900. Sec., M. Peterson. Engineer J. G. Glassco, 54 King St.

The following contracts have been awarded by the board of control for the installation of induction regulators: The Canadian General Elec. Co., Ltd., 146 Notre Dame Ave., for two 3-phase regulators at $4,625; The Canadian Westinghouse Co., Ltd., Portage Ave. E., for 2 single-phase regulators at $2,071. Engineer, J. G. Glassco, 54 King St., Sec., M. Peterson.

(Continued on page 77)

Tenders and For Sale Department

Extension of Time

TOWN OF WELLAND

Pavements

Tenders addressed to the undersigned and marked "Tender for North Main Street Pavement" will now be received until 4 p.m. on the **Ninth day of July, 1914**, for approximately 6,200 square yards in Vitrified Brick, Reinforced Concrete, Sheet Asphalt, Creosoted Wood Block or Bitulithic, which is divided into 1,400 square yards of Street Railway track construction and 4,800 square yards of side construction with curbs, etc.

Plans and specifications may be seen at the office of the Canadian Engineer, 62 Church St., or office of the Contract Record, 220 King Street West, Toronto. Plans and specifications, etc., may also be seen at office of Town Engineer, Welland, where tender forms and all other information may be received.

Sealed tenders fully endorsed must be accompanied with an accepted bank cheque valued at 10 per cent. of tender price.

The Council do not bind themselves to accept the lowest or any tender.

C. M. WEBBER, Town Clerk.
Welland, June 25th, 1914. 26

Tenders for Dredging

Sealed tenders addressed to the undersigned, and endorsed "Tender for Dredging, Ontario," will be received until 4 p.m., **Tuesday, July 14, 1914**, for dredging required at Kincardine, Bruce Mines, Port Hope or Little Detroit, as the case may be.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signature of tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work.

The Dredges and other plant which are intended to be employed on this work shall have been duly registered in Canada at the time of filing of this tender with the Department, or shall have been built in Canada after the filing of the tender.

Contractors must be ready to begin work within thirty days after the date they have been notified of the acceptance of their tender.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for five per cent. (5 p.c.) of the contract price, but no cheque to be for less than fifteen hundred dollars, which will be **forfeited** if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 26, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63733. 26-27

Temiskaming and Northern Ontario Railway

Sealed tenders addressed to the undersigned will be received up to 12 o'clock noon, on **Monday, July 6th**, for the supplying and installing of a hot water heating system in each of three standard No. 2 stations now being erected along the line of the Temiskaming and Northern Ontario Railway.

Plans, specifications, form of tender and instructions to bidders may be seen at the office of the Secretary-Treasurer of the Commission or the office of the Chief Engineer at North Bay, Ontario.

Certified cheques on a chartered bank of Canada payable to the order of the Secretary-Treasurer of the Commission for the amount as shown on the form of tender must accompany each tender.

Lowest or any tender not necessarily accepted.

A. J. McGEE,
Secretary-Treasurer,
26 25 Toronto Street, Toronto.

Tenders for Dredging

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Dredging, McKellar River," will be received until 4 p.m., **Friday, July 3rd, 1914**, for dredging required at McKellar River, Fort William, Ont.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work.

The Dredges and other plant which are intended to be employed on this work shall have been duly registered in Canada at the time of the filing of this tender with the Department, or shall have been built in Canada after the filing of the tender.

Contractors must be ready to begin work within thirty days after the date they have been notified of the acceptance of their tender.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for five per cent. (5 p.c.) of the contract price, but no cheque to be for less than fifteen hundred dollars, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 19, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63370. 25-26

Tenders for Silo

Tenders will be received by the undersigned up till **Thursday, the 9th day of July next**, for the erection of a modern cement Silo, 12 x 28 ft., with roof and ventilator, air-tight doors, excavation for foundation and drainage complete, at the County of Wellington House of Industry and Refuge. Contractor to furnish his own plans and specifications.

WILLIAM GRIFFIN,
Superintendent.
Fergus, June 27th, 1914. 26

NOTICE

CITY OF SWIFT CURRENT,

SASKATCHEWAN

Sealed tenders, endorsed on envelope, "Tenders for Concrete Sidewalk Construction," and addressed to Geo. D. Arnott, City Clerk, to be lodged not later than 5 o'clock p.m. of **Tuesday, July 14th, 1914**, for the construction of Concrete Sidewalks under Contract "E-4."

Quantities as Follows:—

27,571 square feet of 11-ft. 6-in. Walk.
25,410 square feet of 5-ft. 6-in. Curb.
7227.5 lineal feet of 6-in. Curb.

Plans, specifications and full information may be obtained on application to the undersigned.

The lowest or any tenders not necessarily accepted.

WARD CURLEE, City Engineer.
Swift Current, Sask.
June 24th, 1914. 26

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Durham, Ontario," will be received at this office until 4 p.m., on **Monday, July 20, 1914**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the offices of Messrs. Forster & Clark, Architects, Owen Sound, Ont.; Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont.; the Postmaster, Durham, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 27, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63746. 26-27

Sealed tenders, addressed to the undersigned, and endorsed "Tender for Postal Station "E," Toronto, Ont.," will be received at this office until 4 p.m. on **Monday, July 13, 1914**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 17, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—45794. 25-26

Orillia Water, Light & Power Commission

Town of Orillia, Ontario

Waterworks Extensions

Notice to Contractors

Sealed tenders will be received by the Secretary of the Orillia Water, Light and Power Commission, Orillia, Ontario, for the following works:—

Until 9 a.m. Monday, July 27th, 1914.

Contract "A"—Laying water mains.
Contract "B"1—Constructing reinforced concrete coagulating tank and pump house foundation. and brick superstructure.
Contract "C"1—Furnishing cast iron water pipe and specials.
Contract "C"2—Furnishing steel water pipe and specials.
Contract "D"—Furnishing gate valves and hydrants.
Contract "K"—Laying of Intake pipe in Lake Couchiching.

Until 9 a.m. Monday, August 3rd, 1914.

Contract "E"—Furnishing and erection of motor driven turbine pumps and equipment.
Contract "F"—Furnishing and erection of "Diesel" oil engine and appurtenances.
Contract "G"—Furnishing and erection of Mechanical Pressure type filtration plant.

Tenders shall be sealed and plainly marked on the outside Tender "A" or Tender "B," etc., as the case may be. The Commission reserves the **right to reject any or all tenders or to call for** new tenders or to accept any tender that may be in the interests of the Town of Orillia.

Plans and specifications may be seen on and after July 6th, **1914**, at the office of the Canadian Engineer, Toronto, and at the Commission office, Orillia, Ont.

E. LONG, Chairman.
W. K. GREENWOOD, B.A.Sc.,
Engineer.

25-28

Tenders for Pavement

Sealed tenders addressed to G. H. Duncan, Chairman of the Board of Works, City Building, Simcoe Street, Peterborough, Ont., and endorsed "Tender for Pavement," will be received up to 4 p.m., **Wednesday, July 8th, 1914**, for the construction of Bitulithic and Asphaltic Concrete Pavements on Charlotte, Simcoe, Brock, Aylmer and Water Streets in the City of Peterborough.

Tenders will be received for the pavement complete and also separately for the concrete work and the wearing surface.

Plans and specifications may be seen at the City Engineer's Office, Peterborough, Ont. Each tender must be accompanied by an accepted cheque for five (5) per cent. of the amount of the tender as based on the estimated quantities.

The lowest or any tender will not necessarily be accepted.

R. H. PARSONS,
City Engineer.

Peterborough, Ont.,
June 26th, 1914. 26

Sealed tenders addressed to the undersigned and endorsed "Tender for Heating System, Materials, Eastern Block, Ottawa, Ont.," will be received until 4 p.m. on **Monday, July 13, 1914**, for the work mentioned.

Tenders will not be considered unless made upon forms furnished by Department, and in accordance with conditions contained therein.

Specification and list to be seen on application to Mr. R. L. Deschamps, Overseer, Post Office, Montreal, to Mr. Hastings, Postal Station "F," Toronto, Ont., and at the Department of Public Works, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 29, 1914. 26

Tenders Wanted

Sealed tenders will be received by the undersigned, by Mr. S. E. Smith, Warden of Perth County, Listowell; and Mr. George Dickson, Rothsay P. O. Ont., up to 12 o'clock on **Saturday, July 11th**, for the construction of the following:—

(1) Abutments and Wingwalls for steel beam span to be built on the line between Perth and Wellington, opposite Lot 5, Township of Mornington.

(2) Steel Beam Span 24 ft. clear, located as described above.

(3) Approaches for above bridge.

Tenders will be opened at the Queen's Hotel, Listowell, on Saturday, the 11th day of July at 1 p.m. A marked cheque amounting to 5 per cent. of the tender to accompany said tender.

Plans and specifications may be seen at the County Engineer's Office; at Mr. Geo. Dickson's and at Mr. S. E. Smith's.

JOHN ROGER,
County Engineer, Perth.
Mitchell, Ont.

26-27

For Sale

Oak Piles, 30/60 ft.
Pine and Hardwood Piles, 30/60 ft.
Oak timber cut to order.

THE BRADLEY COMPANY,
Hamilton, Ont.

25-26-27

Residences

(Continued from page 75)

Belleville, Ont.
Plans have been drawn for the construction of a $7,000 residence on Albert St., for Fred Quick, 32 Queen St. Architect, A. Rolo, Duggan Ave., Toronto. Building will be 3-storeys, 32 x 34, stone and concrete foundation, frame and pressed brick construction, shingle roofing, gas and electric lighting.

London, Ont.
Plans are in progress for the construction of a $7,000 residence on 34 Marley Street for E. T. White, 167 Wortley Rd. Architect, A. E. Nutter, Dundas & Richmond.

W. J. Mooney, c/o London Collegiate Institute, contemplates the construction of a $7,000 residence. Red pressed brick construction, stone and concrete foundation, gas and electric lighting, plumbing.

London Twp., Ont.
Plans are in progress and the architect, A. E. Nutter, Dundas and Richmond, will receive tenders for a $6,000 residence to be erected by J. Geary.

Montreal, Que.
The projected construction by Laroque & Bonard, 1654 Esplanade Ave., of an apartment house on Christophe Colombe at an estimated outlay of $35,000, will not take place this year.

The construction of stores and flats at Longueuil, at an estimated cost of $10,000 will not be carried out this year by the owner, Mr. Jno. Girouard. Architects, Beaugrand, Champagne & Chenevert, 182 St. Catherine E.

The construction of an apartment house on Drummond St. will not be carried out this year.

Montreal, Que. (Outremont)
The general contractors, Guertin & Bouchard, 410 Parthenais, will call tenders for some sub trades in about two weeks in connection with the erection of a residence in Outremont for E. P. Dame, 312 Bleury street.

Contracts for painting and plastering will be let shortly in connection with structural alterations to cottages at a cost of $15,000, for P. P. Boileau, St. Viateur Street. Architect, S. Frappier, 2238 Park Ave., Montreal.

Montreal, Que. (St. Henry)
The contemplated construction of 18 flats at an estimated cost of $25,000 on Beaudoin street for E. Lepage, will not be carried out this year.

Montreal, Que. (Westmount)
Prices are being taken on heating and plumbing by Chas. Brown, general contractor, 4263 St Catherine St., for the construction of a $10,000 residence.

Niagara Falls, Ont.
Tenders are invited by the architect, E. D. Pitt, Victoria Ave., for additional

storey and veranda, 40 x 36, oak floors, fireplace, patent lath, additional hat water radiators, to Chas. Ballard's residence, Bank of Commerce Bldg.

North Bay, Ont.

Plans are in progress for the construction of 2 residences, at an estimated cost of $9,000, for Henderson & Angus, Fraser St., architects and general contractors.

Ottawa, Ont.

The contract has been awarded to L. Bangs, 480 Cooper, for the construction of $6,000 addition to apartments for Sam Stewart, 422 MacLaren. W. Herbert George, Castle Bldg., Queen St., is the architect.

The construction of a $6,000 residence on Powell is contemplated by Sam McCracken, 145 Flora.

The construction of a theatre at an estimated cost of $7,000 on Somerset St. is in contemplation. J. S. Crawford, 19 Aylmer Ave., is interested in the building, which will be of brick construction.

The construction of $6,000 stores and residences on Creighton Street for August Boehmar, 280 Creighton, is contemplated.

The architects, Weeks & Burgess, Sparks street, expect to call tenders about July 16th for the erection on Somerset street of $80,000 stores and apartments for John Fixter, 35 Waverley. Building will be four storeys, steel and brick construction.

Plans are drawn for a $12,000 residence to be erected on Blackburn St. for Abraham Levinson, 118 Goulbourne. Architect, W. Herbert George, Castle Bldg., Queen St. Building will be stone foundation, stucco and solid brick construction, shingle roofing.

Regina, Sask.

The following permits have been issued for the construction of residences: One $5,000 residence on Garnet Street for George Curry, 1456 Cameron; one $2,500 residence on Stuart for J. Geary. Johnson & Mills, Westman Chambers, are the general contractors. One $6,000 residence for Scriminger & Pyke. W. Patterson, 1164 Rae Street, is the general contractor. One two-storey $3,500 residence on Dewdney street, for W. T. Bennett, 2265 Osler street.

St. Jerome, Que.

Plans will be commenced shortly in connection with the erection of a Presbytery near St. Jerome, Que., by the architect, L. J. T. Decary, New Birks Bldg., Montreal.

Toronto, Ont.

The general contractors, Colwell & Yonde, 787 Euclid Ave., invite prices on excavating, concrete and brick work, in connection with the construction of an $8,000 residence on Warren and Heath.

Tenders are still open for the construction of three stores and apartments on Danforth and Arundel for H. J. Hollindrake, 100 Church street. Tenders will be considered in bulk or separate.

Tenders are required in connection with the erection of a $12,000 detached residence on 15 Biggar Ave for Chas. Ruse, 52 Oakwood Ave. L. E. Ruse, 1073 Dundas street, general contractor lets contracts and buys material. No contracts yet awarded except masonry.

Tenders are wanted for a cement cellar in connection with the $5,000 residence on 112 Lytton Blvd. for D. Gould, 275 Roxton Road. Supt. of Construction R. L. Hamwood, 442 Brock Ave.

Tenders are open for the slate and gravel roofing and electric wiring contracts in connection with the construction of a $6,500 residence on Scarth Rd. for P. McKissock, 526 Bathurst St., owner and general contractor.

Tenders are open with the architects, Eden Smith & Son, 199 Yonge St., for the construction of a residence on Dunvegan Rd., for Dr. W. P. Caven, 70 Gerrard E.

Winnipeg, Man.

A permit has been issued for a $20,000 residence on Ingersoll street for F. E. Halls, care Carter-Halls-Aldinger Company, 1010 Union Bank Bldg., architect and general contractor.

Plans are drawn for the construction of a $45,000 apartment block on Toronto Street for J. M. Kamen, 642 Somerset Block. Architect, D. Abramovitch, McIntyre Block. Day labor will be employed.

CONTRACTS AWARDED

Chatham, Ont.

The contract for all work in connection with the construction of a $2,338 residence has been awarded by the Waterworks Dept. of the city council to Sparks Bros., 5 Grand Ave. W.

Montreal, Que.

Hochelega School Commrs. have let the general contract for the construction of a $39,000 residence on Chambly St., to O. Chauvin, 98 Darling St. Sec.-Treas., W. Desjardins, 236 Chambly St.; architects, Viau & Venne, 76 St. Gabriel St.

Ottawa, Ont.

The following contracts have been awarded in connection with the contemplated erection of a $10,000 residence in Rockcliffe Park for C. Coutlee. Masonry, Alexander & Campbell, 245 Bank; carpentry, W. Adamson, 126 Sparks St. Architects, Horwood, Taylor & Horwood, 130 Sparks St.

Winnipeg, Man.

The contract has been awarded for the erection of an $8,000 residence at Kingsway, the general contractors being J. Bishop, 91 McAdam Ave. Owner, L. Gregory, care architect, J. N. Semmens, McArthur Bldg. Building will be 2½ storeys, brick construction.

Power Plants, Electricity and Telephones

Montreal, Que. (Outremont)

The town council contemplates the calling of tenders for the erection of poles for street lighting. Mayor, M. Beaubien; engineer, J. Duchastel, Town Hall, Outremont.

Rossland, B.C.

The West Kootenay Power & Light Company contemplate the construction of a new lighting system.

St. Catharines, Ont.

Estimates have been prepared for the laying of an ornamental, underground lighting system for the Hydro-electric Commission as follows: 105 single light standards with 1,000 candle-power lamps spaced on St. Paul, Queen and James streets, approximate cost $11,304; 61 single light standards with 100 watt lamps spaced on Church and Ontario streets, approximate cost $6,093. Chairman Commission, J. S. Campbell.

Simcoe, Ont.

The town council has passed a by-law to raise $40,000 for the construction of the plant for street and commercial lighting. W. C. McCall is the clerk.

Walkerville, Ont.

The Provincial Hydro-electric Commission, Toronto, intend subletting the roofing contract in connection with the erection of a transforming station on Walker Road, at a cost of $9,500. Wells & Gray, Windsor and Toronto, general contractors.

Let us quote you on
"DeLAVAL" Turbine or Motor Driven **Pumps**, etc.
"FULTON" Stokers.
"WEBER" Reinforced Concrete **Chimneys.**
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Sewage Disposal Apparatus
E. LAURIE COMPANY
243 Bleury Street, Montreal

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Clay Products

are as proof against the elements as

The Pyramids of Egypt

C. J. Read,
Architect.

Shea's Hippodrome
Toronto

Fred Holmes & Sons, Limited
Contractors.

Sun-Tex gray stock brick were used to face the side wall and back of Shea's Hippodrome.

Sun-Tex Brick were also selected for a large percentage of the Interior work.

Sun-Tex Clay Products are uniform in size, color and texture, and possess unequalled wearing powers.

The One Price Company

Sun Brick Company, Limited

Traders Bank Building, Toronto

Vault Doors and Safes

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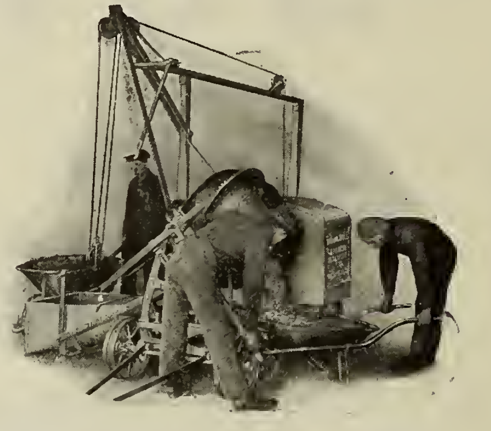
STOP! - LOOK! - LISTEN!
just the Mixer you've been wishing for
The "Big-an-Little"

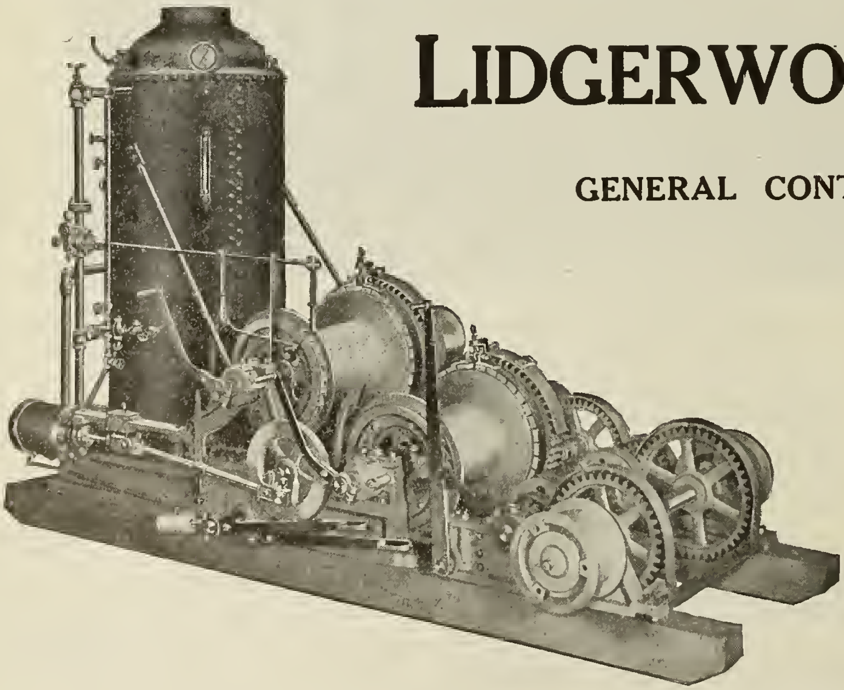


1914 Model now ready

The small mixer has proved its worth. You know it pays better to have one or more small portable mixers than to mix by hand or to have a great big clumsy mixer. The question has been to get a Dependable Small mixer at a low price.

The "Big-an-Little" is the biggest and best small mixer on Earth, and our Low Prices amaze the Mixer World. They are used everywhere. Write us NOW.

The Jaeger Machine Co.
Columbus, Ohio



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GENERAL CONTRACTING WORK

Double Cylinder, Double Friction Drum Engine and Boiler with Boom Swinging Gear.

See Bulletin No. 11

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Our Welland plant will be ready to furnish ***Carbon, Manganese, Alloy Steel Castings*** and ***Forging Ingots,*** by the end of May, made by the Electric Furnace process.

This process makes a dependable high grade steel and steel casting, a tough homogeneous material, free from blow-holes, and having a remarkable resistance to fatigue.

Write us for prices and particulars

The Electric Steel & Metals Co., Ltd.
Welland, Ontario

ERIE

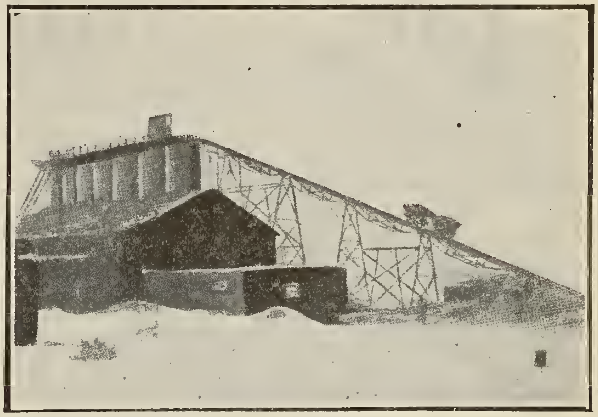
Steel Frame Barrow

"Erie" Barrow No. 34 like others of this line has guarded wheel and forward or side dump; welded steel tray without rivets and braced channel steel legs.

"Erie" Barrows are made for all purposes. Our prices are right and our goods the best.

Send for particulars.

The Erie Iron Works, Limited
ST. THOMAS, ONT.



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GALVANIZED WIRE-WOUND for waterworks systems, irrigation, etc.

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COSTS LESS THAN IRON OR STEEL AND AS DURABLE.

NATIONAL PIPE & FOUNDRY CO., LIMITED
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It's the one always-correct color in a brick building.

We make nothing but red brick.

"PRESSED
BRADFORD
BRICK"
(TRADE MARK REG. U. S. PATENT OFFICE)

A distinctive, unfading red, made from the celebrated Bradford red shale.

"Bradford Reds"

The ideal red facing brick, for fine residences and public buildings.

Made in both dry-press and impervious.

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A fine rough textured red brick for grills, garden walls and striking rustic effects.

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We also make fire-proofing, hollow brick and hollow block.

Bradford Pressed Brick Co.
"The Red Brick People"
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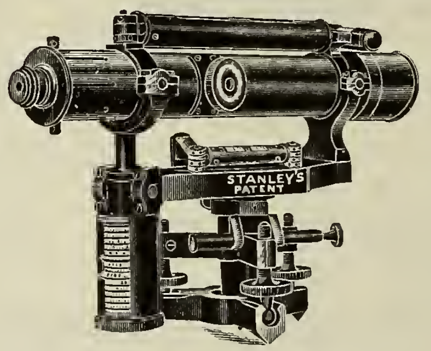
NORTHERN CRANES

All types of Good Cranes, Electric and Air Hois^t^

NORTHERN CRANE WORKS LIMITED
WALKERVILLE, ONTARIO

TRADE **STANLEY** MARK



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Locomotives and Cars

Jno. J. Gartshore, Toronto

S. M. Underhill's Bungalow, Stained with Cabot's Creosote Stains and lined with Cabot's Quilt. Designed and built by Tracy L. Freeman, Nyack, N. Y.

"Cabot's Stains are the only Stains I use when I get up the specifications, and if I build where other's specifications call for other stains I try and get them over to Cabot's, for I know the results are better for all concerned." TRACY L. FREEMAN.

THE ONLY REAL STAINS

If you have only seen the crude and tawdry colors of the thinned-paint imitations of

CABOT'S SHINGLE STAINS

you have no idea of the beautiful coloring effects of the true Stains. They are soft and deep, like velvet, but transparent, bringing out the beauty of the wood grain. Half as expensive as paint, twice as handsome, and the only Stains made of Creosote, "the best wood preservative known."

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Designs and estimates furnished on application.

John verMehr Engineering Co.
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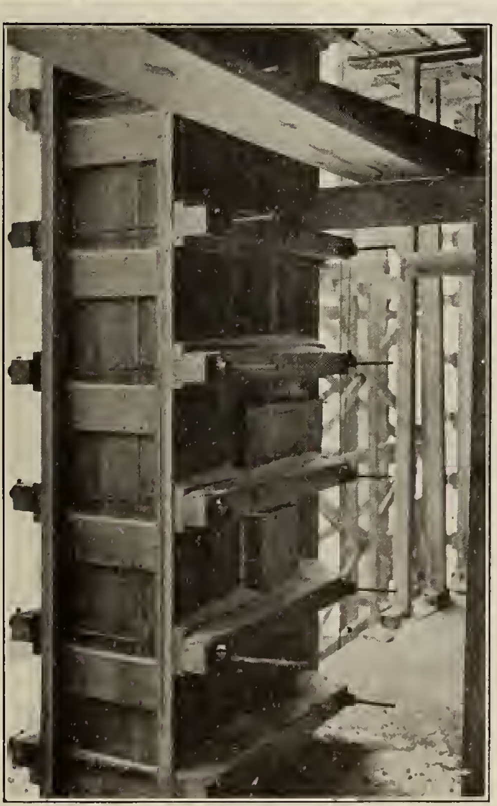
154 Simcoe Street, Toronto



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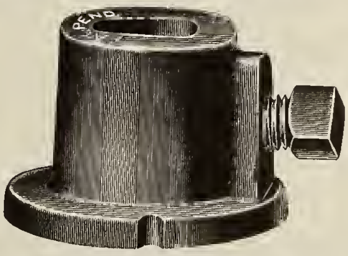
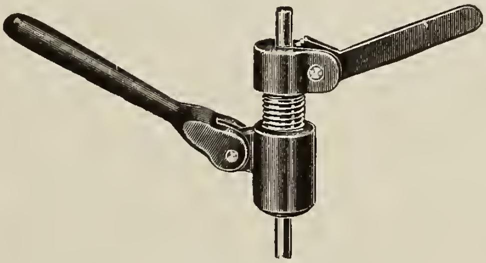


This clamp is a POSITIVE locking device when used upon a rod. Clamps may be nailed to forms, thus preventing loss. Tie is secured in 50 per cent. less time than by use of bolt and nut.



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Should it be necessary to force form back into place, put clamp on rod and follow up with the tightening wrench, large handle next to clamp, tighten cam and use as screw-jack. Set clamp and remove wrench. This insures a straight and true job.

Universal Form Clamp

This clamp is literally universal in application.

With these, low cost cast iron clamps and various lengths of steel rods, forms may be held rigidly in place during the entire process of building.

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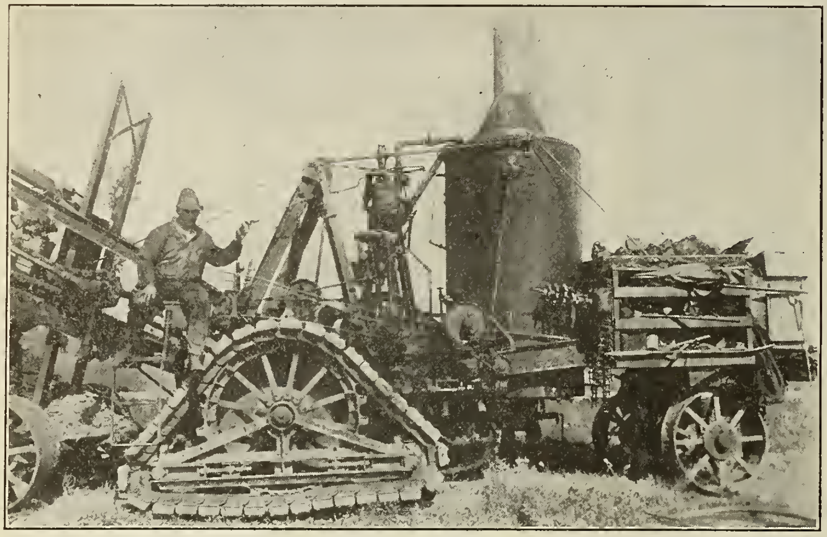

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INVESTIGATE the merits of the **PARSONS TRENCH EXCAVATOR.** We will gladly inform you where you can see a **PARSONS** at work in your vicinity. At any rate write for the Parsons Catalog.

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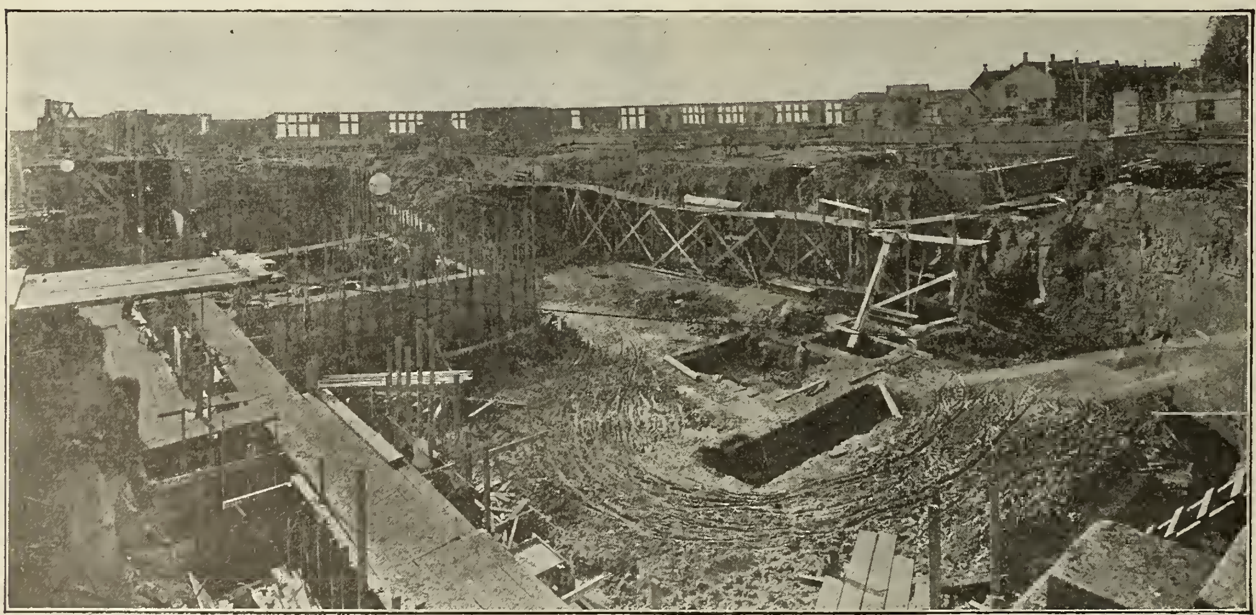

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The Berlin Rubber Manufacturing Company, Limited, Berlin, Ont.
The Maple Leaf Rubber Company, Limited, Port Dalhousie, Ont.
Dominion Rubber Company, Limited, St. Jerome, P.Q.
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This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

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- Building ready for occupancy July 15th.

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Steel Pressure Blowers

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This blower will give you the same satisfactory service under similar conditions.

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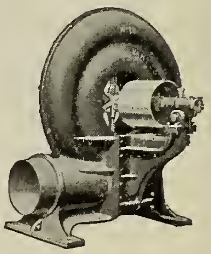

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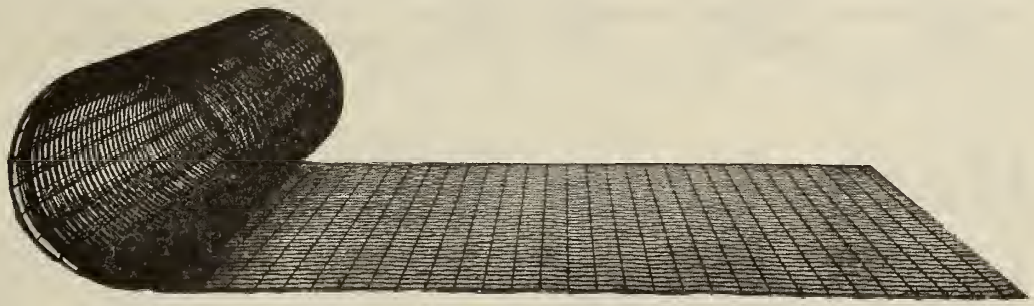

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Our Cars are strongly built and braced throughout and nothing to get out of order on them.

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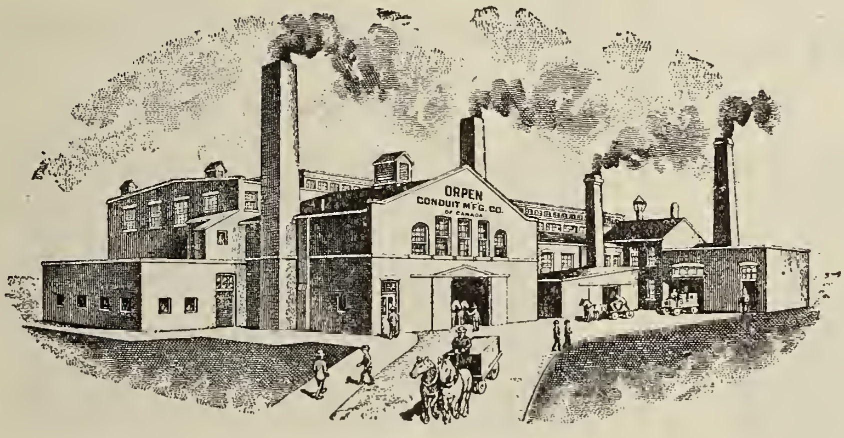

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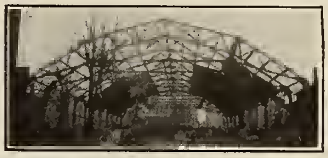

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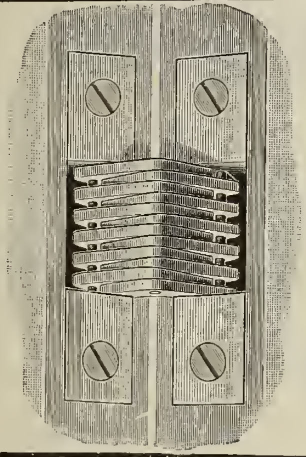

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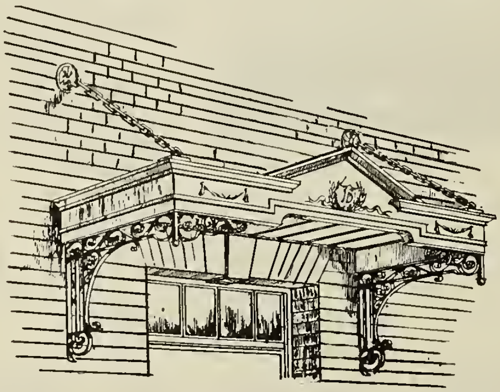

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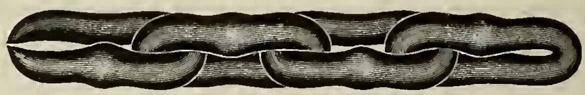
has a 25% factor of safety over the same size of any other make. A swell of 25% added material at the weld makes that point the strongest part of the link.



Guaranteed to pull stiff before breaking and not to break at weld.

Sizes 3/16″ to 3/4″ inclusive.

Made in Canada by

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EQUIP YOUR CELLAR

with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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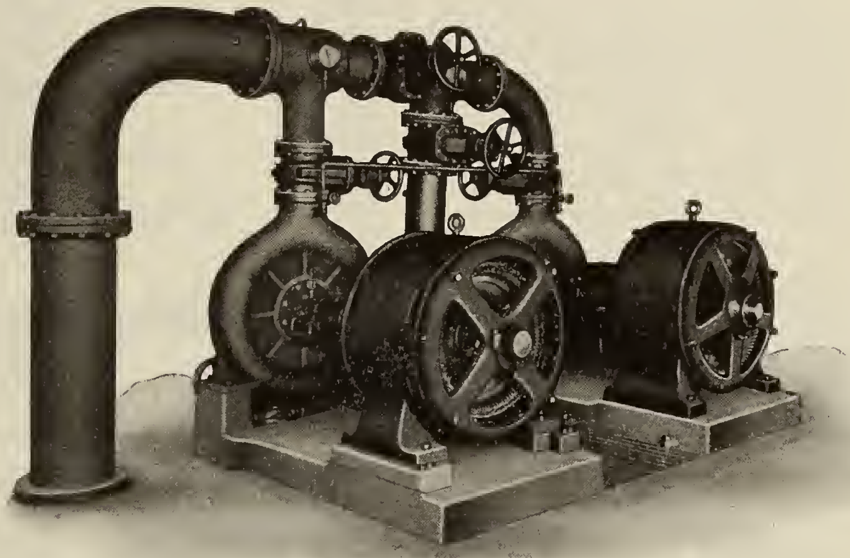

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The brick that sells itself.

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Is made to precise formulae by weight and mixed by machinery. No guess work. No unreliable labor. It sets quickly and hard, works easily and covers large area. No frost troubles. No cracking.

Put up in bags ready for immediate use by mixing with water only.

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The material mentioned here comprises the full line of the Metallic Roofing Company's manufactures.

From time to time in this space the various items will be discussed. At this writing, however, we wish to emphasize the "Quality" which has been the keynote of the "Metallic" success.

Since we commenced manufacturing in 1884 we have continuously maintained a high standard of Quality in Materials, Workmanship and Service.

To the Dealer and Contractor, this "Metallic Service" means real, tangible help.

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- Eastlake "Steel Shingles"
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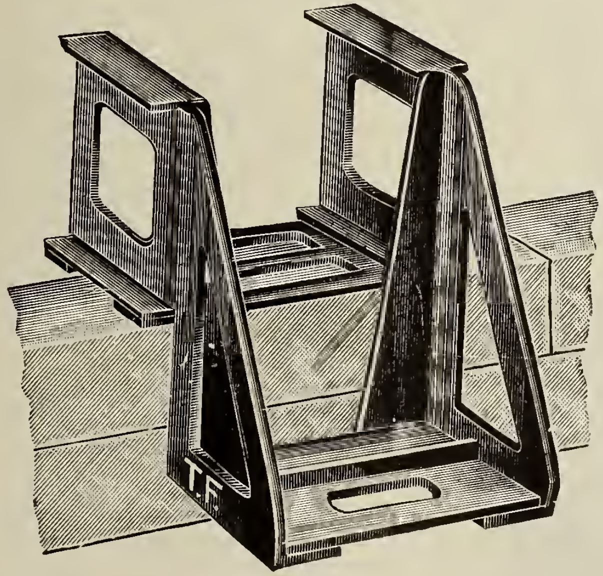

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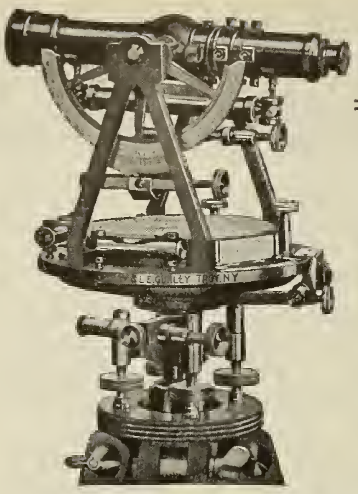

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Are today giving satisfactory service to an increasingly large number of

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Rigid. Accurate. Light. Adaptable.

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With our 9 Branch yards situated as they are we are prepared to guarantee a prompt delivery service of any orders you may favor us with and would ask you to give us a trial in order that we might prove same to you and also prove the excellence of our material.

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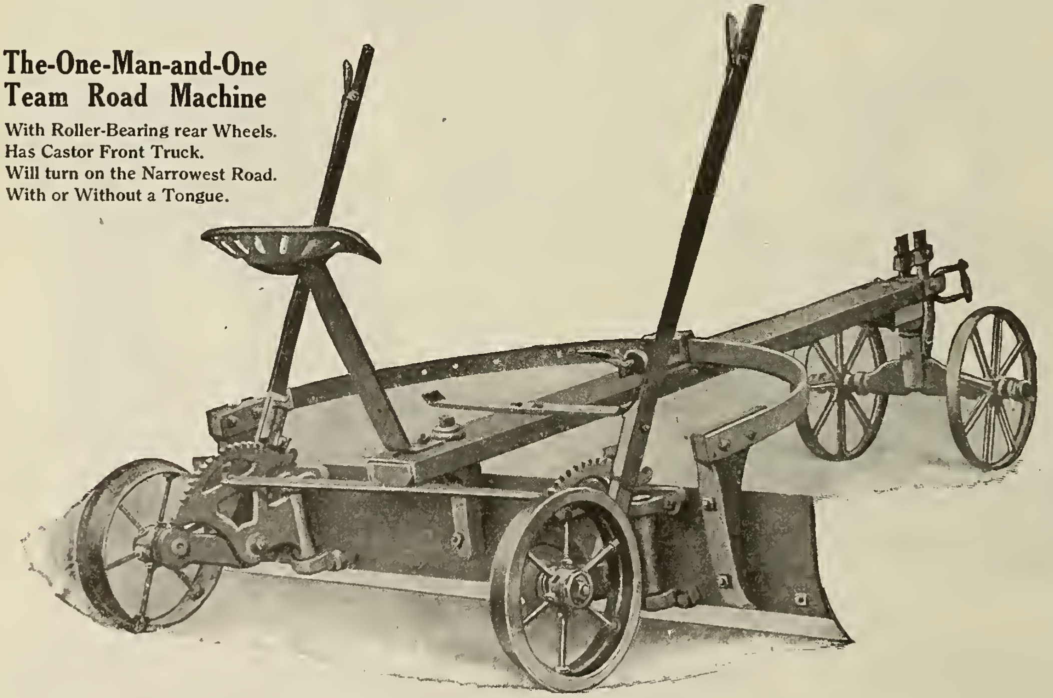
The-One-Man-and-One Team Road Machine

With Roller-Bearing rear Wheels.
Has Castor Front Truck.
Will turn on the Narrowest Road.
With or Without a Tongue.



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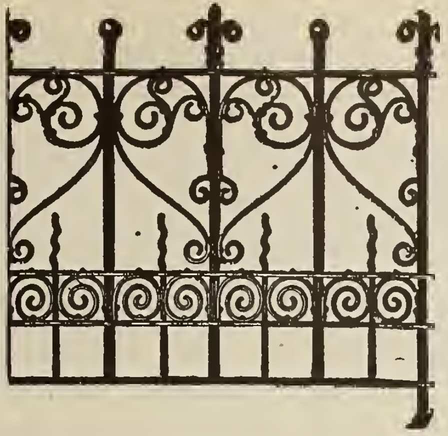

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Send in your specifications and get our quotations.

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We have no affiliations or working acquirements with any of our competitors.

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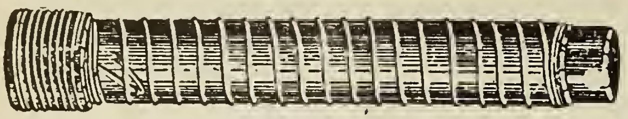

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Reservoir Tanks for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

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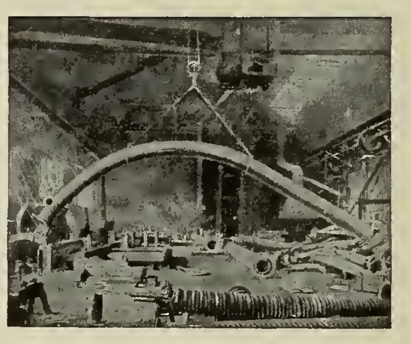

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eliminate heavy fittings
economize space,
avoid leaky joints,
save trouble, room and money

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Flexible and Flange Pipe,
Special Castings and all kinds
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3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

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STEAM CRANE HOISTS
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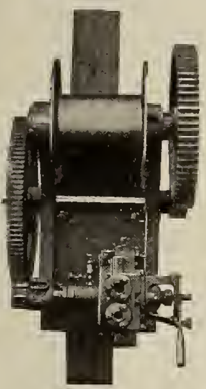

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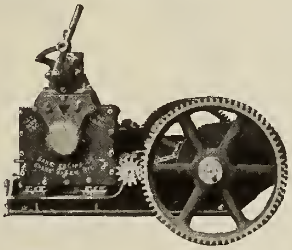

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"Queenston Blue" Limestone

in Sawn Slabs

as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

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Crushed and Rubble Stone

Our quarry has a capacity of 300 tons per day, and with excellent shipping facilities we can supply your requirements in all sizes of this stone on shortest notice.

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for Interior Construction

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Cawthra Mulock, President - - Gordon F. Perry, General Manager

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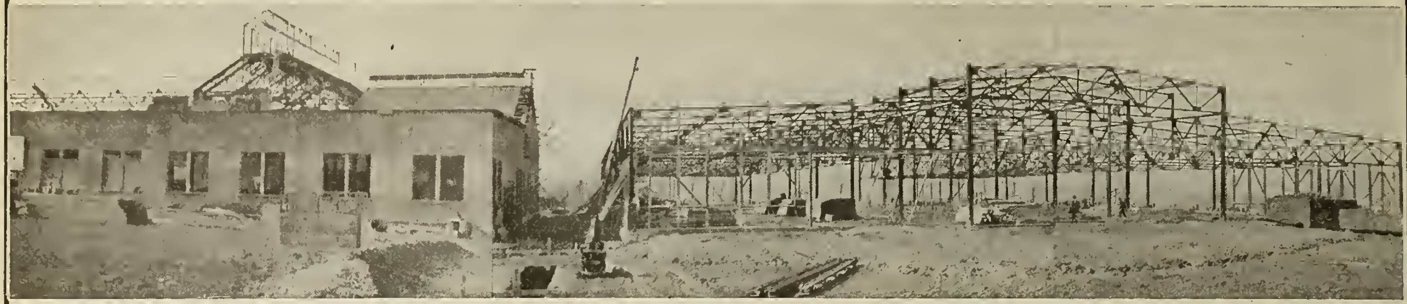
THE HAMILTON BRIDGE WORKS COMPANY, LTD., Hamilton, Canada



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World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

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will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a **HEINICKE**

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RED RUFFESTRY BRICK
FLASHED PRESSED BRICK
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We guarantee prompt shipment and satisfactory delivery.

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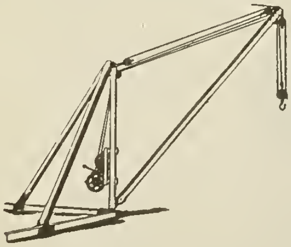

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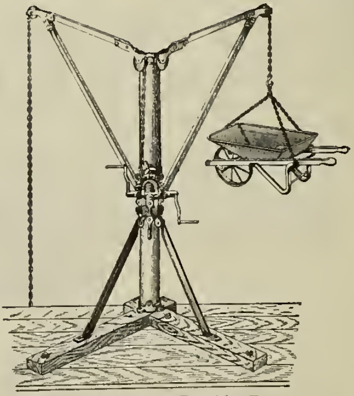

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Neptune Meter Co.

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TRIDENT Frost-Proof Water Meters

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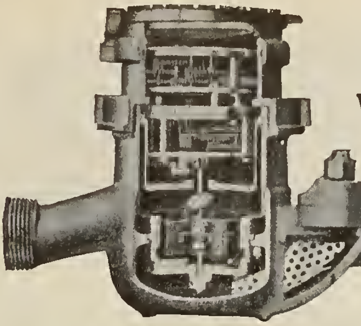

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Vane Wheel
Water Meters

Dry
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The Main Advantages:

Simple, solid construction, involving only a few easily interchangeable parts. Best workmanship and accurate adjustment. Large sack-like strainer which has five to ten times the clear cross section of the connecting sockets. This can be taken out without removing meter from pipe. All toothed wheels are cut on special machines, not stamped. Only the best celluloid is used for vane wheels. Meters are fitted with regulating device easily adjusted from outside. Graphite is used for bearings of vane wheel shaft, rendering oiling of bearings unnecessary and is not influenced by water containing salts or acids. Frost proof device.

Siemens have been making water meters for the last fifty years.

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MEXICAN EAGLE ASPHALT
TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

Purchase MEXICAN EAGLE ASPHALT because:

1—It is more cementitious than other asphalts.
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6—Shocks will not crack it. It is very malleable.
7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it
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The Asphalt and Supply Co., Limited
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BELL AND SPIGOT STEEL PIPE

COATED AND WRAPPED

Made in sizes from 2" to 10" inside diameter with different thicknesses for varying pressures.

PAGE-HERSEY
Iron, Tube & Lead Co., Limited
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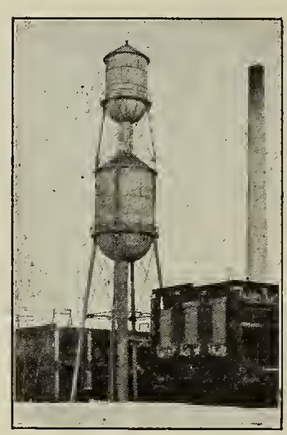
STEEL TANKS



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120,000 "	100 feet to top

Hemispherical and Segmental Bottoms

Manufactured at Pittsburgh, Pa.

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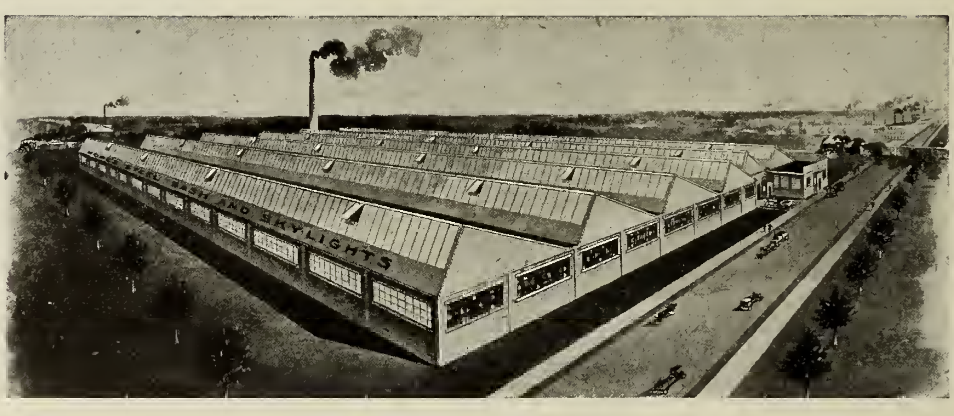
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THE HOPE CANADIAN FACTORY

HOPE STEEL SASH

Embodies points of merit that make it worthy of your consideration. Scientifically designed and economically constructed it recommends itself to discriminating architects and engineers.

HOPE SASH has demonstrated its superiority in thousands of buildings in Canada and the United States as well as other parts of the world. It is a sash with a reputation for excellence back of it.

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We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

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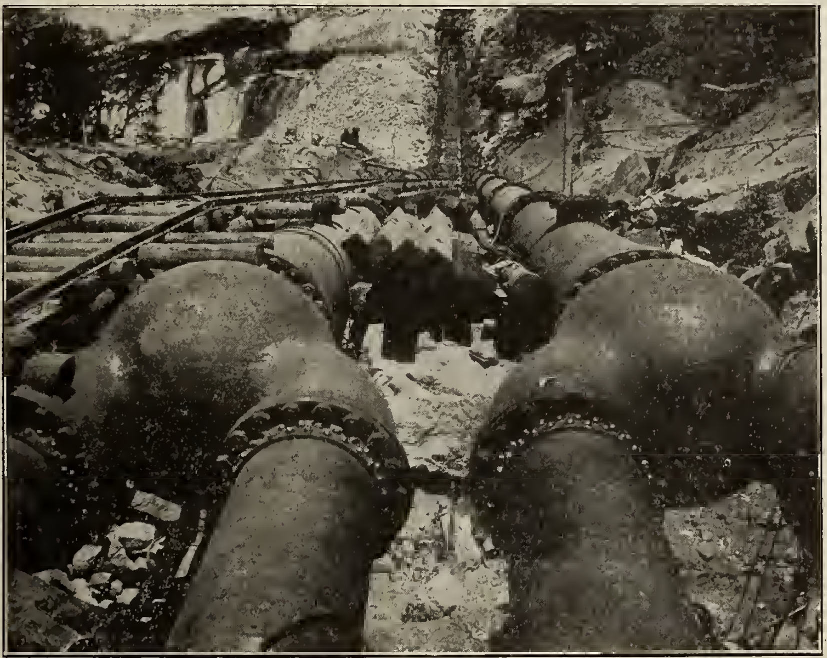
MANNESMANN STEEL TUBES



High Tensile Strength and Great Ductility

are outstanding features of the material from which Mannesmann tubes are made, so that our shells can be much thinner than those of cast-iron pipes. The sockets are made thicker than the tubes to prevent vibration while caulking. The weight of a steel tube is from one-third to one-half that of a cast-iron main of the same diameter and same length. This decreases transportation charges. Steel can be laid much nearer the surface than cast-iron, the steel being immune from breakage by traffic or other causes. This lessens the amount and cost of excavation. Mannesmann tubes can be bent cold on the job, without difficulty. Our special covering is a non-conductor, preventing damage to gas or water mains by electrolysis, or by extremes or variations of temperature.

Write today for descriptive booklets.

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Concrete Bonding
Elevator
Overhead Guards

Enquiries solicited.

CANADA WIRE & IRON GOODS CO., Hamilton

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Local Agents Wanted in
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Water Filters 1,000 to 1,000,000 Gallons a Day
Refrigerating Machinery 1/4 to 60 Ton Daily Capacity
Water Purifiers 4 Gallons to 5,000 Gallons a Day

Refrigerators and Refrigerating Boxes for Ice or Machine Refrigeration
Hotel, Restaurant and Saloon Equipment and Supplies

EQUIPMENT & SUPPLIES, LIMITED
302 McGILL BLDG., MONTREAL, P. Q.

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11.50 to $12; wire-cut brick for foundation work, $9.50 to $10; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $32; sand-lime brick, $8.60, King Edward siding; $7.50 at the mill; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SUNDRIES AND SPECIALTIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 66c per gal. of 9 lbs.

Raw linseed oil—in bbls., 63c per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 69c.

MONTREAL PRICES

BRICK, CEMENT AND LIME

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

IRON, STEEL, ETC.

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15c basis per pound; British manilla, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 65c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

LUMBER (BUILDING MATERIALS)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 lbs.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12.

(Continued on page 106)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

Warehouse Stocks :
SYDNEY, N. S.
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WIRE NAILS and other **WIRE PRODUCTS**

Improved Concrete Mixers

The Exeter Concrete Mixer as shown by accompanying illustration, is a batch mixer, drum type, with discharge chute. We claim good workmanship, high grade materials, and the best mechanical design, which gives a machine of the very best wearing qualities. The drum is made of a high grade semi-steel and all parts are carefully and accurately fitted, with sufficient strength to insure a minimum maintenance cost.

The mixers are equipped with either steam engine and boiler, power loader, gasoline engine, electric motor, belt or chain drive, or without power, as may be desired, and on either steel trucks or skids. These machines can be arranged to work as hot mixers, for melting asphalt, thawing out material and mixing bituminous macadam. Estimates furnished for any type mixer required.

Rock & Power Machinery
Limited
Exclusive Canadian Agents for
Exeter Machine Works
Head Office 12 King St. E., Toronto
Branch Offices at—Vancouver, Sudbury, Montreal,
Cobalt, Halifax and in the King Edward Hotel, Toronto

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from p. 104.)

CRUSHED STONE, SAND, GRAVEL, ETC.

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton.

Paints and Oils—White lead, ground in oil, $9.00 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

SEWER PIPE, STEEL AND IRON

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

Steel—Round bars, $2.40 per 100 lbs.; square twisted, $2.50 per 100 lbs.; channels, angles, beams and plates, $2.90 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONESAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.75; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SUNDRIES AND SPECIALTIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

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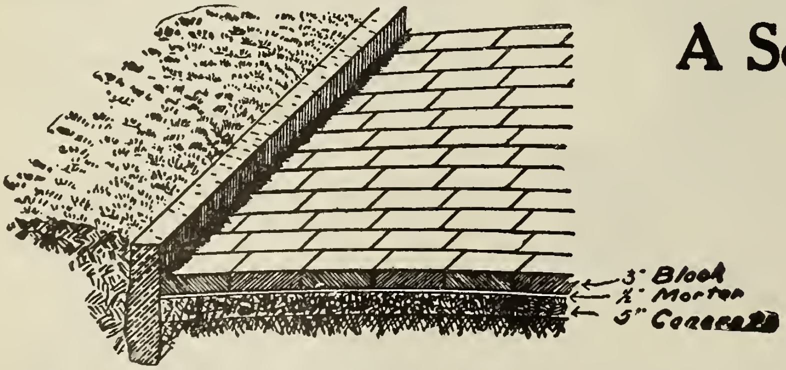

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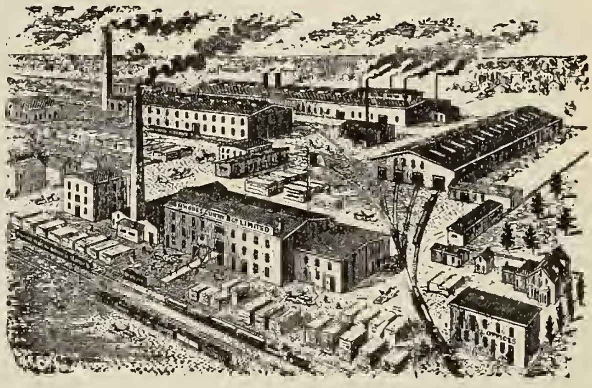

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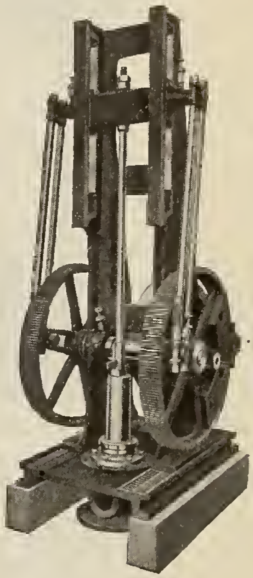

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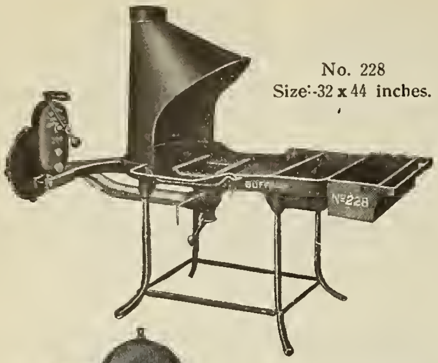

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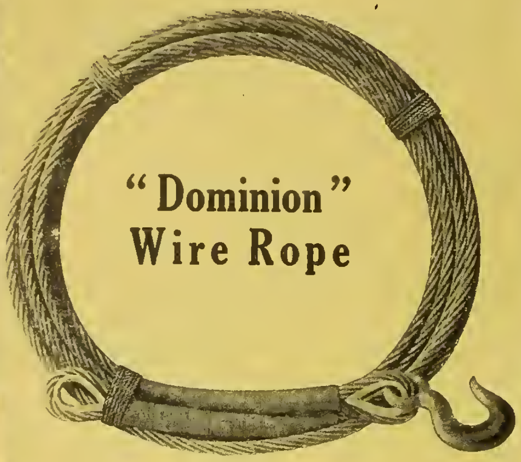

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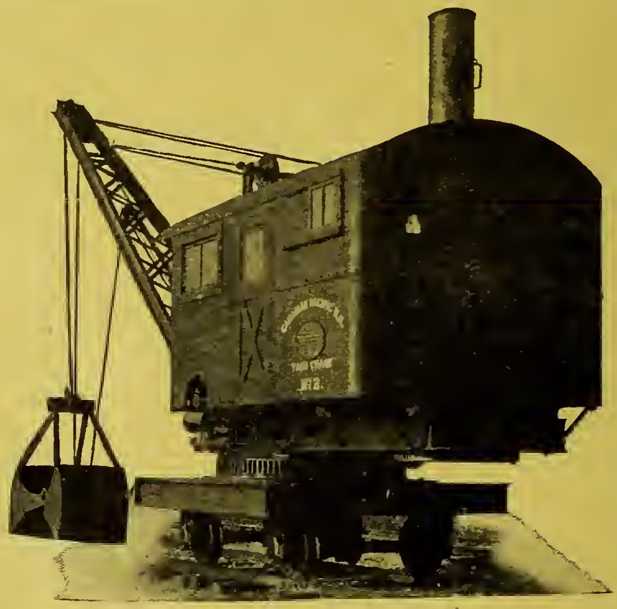

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Vol. 28 Toronto, July 8, 1914 No. 27

Contract Record and Engineering Review

ESTABLISHED 1886

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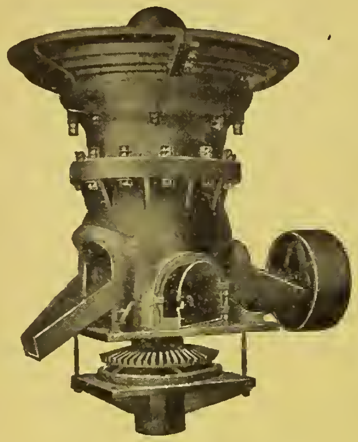

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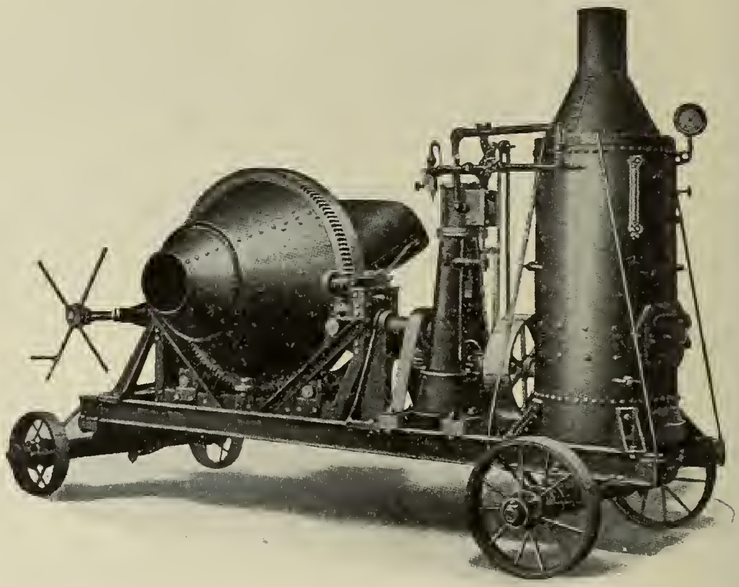
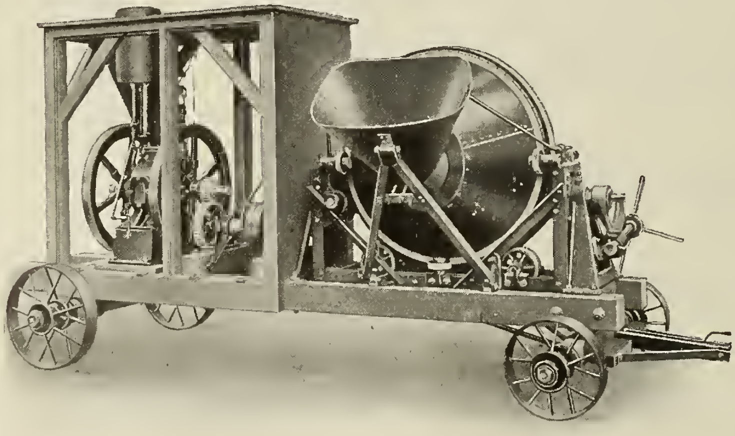
is prepared for any emergency. They Have No Weak Spots.



Standard Smith Mixer on Trucks with Boiler and Engine.



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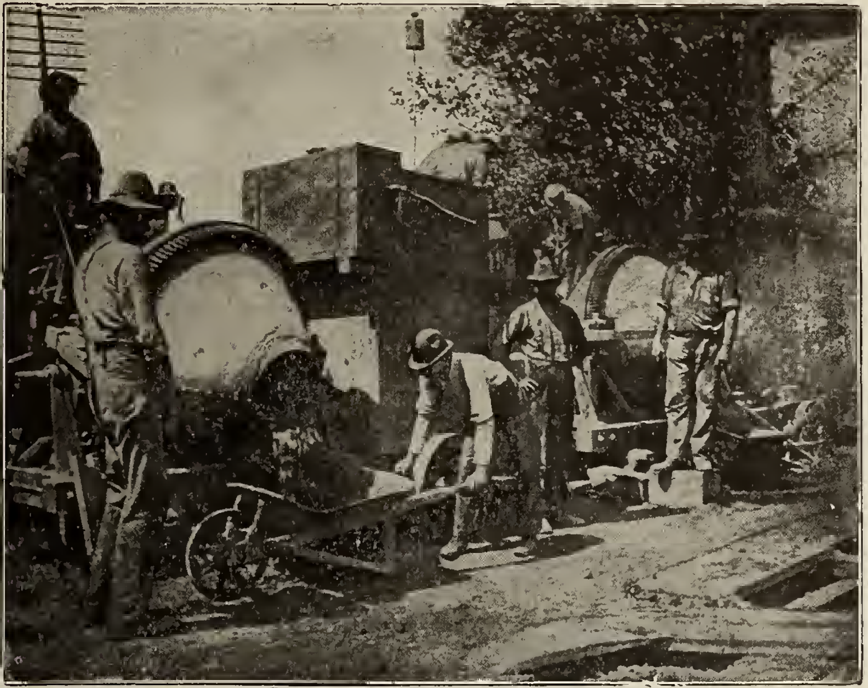

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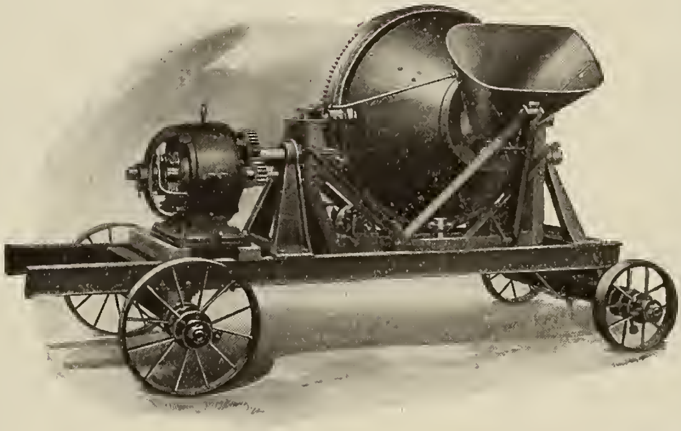

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Berg Machinery Mfg. Co.
Sheldons Limited
Sutcliffe, Speakman & Co.

Bridges (Steel)
Canadian Allis-Chalmers, Ltd.
Canadian Bridge Co.
Chicago Bridge & Iron Works
DesMoines Bridge & Iron Co.
Dickson Bridge Works
Dominion Bridge Co.
Hamilton Bridge Works Co.
Mackinnon-Holmes & Co.
Manitoba Bridge & Iron Works
Maritime Bridge Company
National Bridge Company
Pittsburgh-DesMoines Steel Co.
Sarnia Bridge Co.
Structural Steel Co.
Standard Steel Construction Co.

Buckets
American Hoist & Derrick Co.
Browning Company
British Mfrs. Assn. of Canada
Canadian Fairbanks-Morse Co.
Lecky & Collis
Manitoba Bridge & Iron Works
Mills Bros.
Radigan Company, John
Sudbury Construction & Machinery Co.
Thew Shovel Company
Weller Mfg. Co.

Builders Hardware
Aikenhead Hardware Limited
Can. Yale & Towne, Limited
Richards-Wilcox Canadian Co.

Cable
Canada Wire & Cable Co.
Northern Electric Co.
Standard Underground Cable Co. of Canada, Limited

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Hope & Sons, Henry

Cast Stone Block Machinery
Canadian Zagelmeyer Co.

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Alsen Portland Cement Co.
Britnell & Company
Bremner, Alex.
Canada Cement Company
McNally & Co., W.
Morrison & Co., T. A.
Ontario Lime Co., Ltd.
Rogers, Alfred, Limited
Smyth & Ryan

Cement Coating
Dougall Varnish Company
Wadsworth Howland Co.

Cement Mill Machinery
Hull Iron & Steel Foundries
Jenckes Machine Company
Sutcliffe, Speakman & Co.

Cement Tools
Abram Cement Tool Co.
Wettlaufer Bros.

Chain
McKinnon Chain Company

Chain Blocks
Can. Yale & Towne Limited
Morris Crane & Hoist Co., Herbert

Coal Chutes
Galt Stove & Furnace Co.
Manitoba Bridge & Iron Works

Coal Handling Apparatus
American Hoist & Derrick Co.
Browning Company
Brown Hoisting Machinery Co.
Weller Mfg. Company

Concrete Form Clamps
Railway Contractors Supply Co.

Concrete Machinery
Canadian Zagelmeyer Co.

Concrete Mixers and Appliances
Austin Drainage Excavator Company, F. C.
Badger Concrete Mixer Co.
Canadian Allis-Chalmers, Ltd.
Canadian Concrete Appliance Co.
Hopkins & Co., F. H.
Jaeger Machine Company
Koehring Machine Co.
Knickerbocker Co.
Lecky & Collis
London Concrete Machinery Co.
Marsh Capron Company
Mills Bros.
Municipal Engineering & Contracting Co.
Mussens Limited
Power & Mining Machinery Co.
Rock & Power Machinery
Sutcliffe, Speakman & Co.
Wettlaufer Bros.

Contractors
Anglins Limited
Eastern Pipe Construction Co.
Foundation Company, Limited
Reggin & Spence
Wells & Gray

Contractors' Plant & Supplies
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Austin Drainage Excavator Company, F. C.
Badger Concrete Mixer Co.
Barber Asphalt Paving Co.
Bateman Wilkinson Co.
Beatty & Sons, M.
Browning Company
Canadian Allis-Chalmers, Ltd.
Can. Billings & Spencer
Canadian Fairbanks-Morse Co.
Canadian Locomotive Company
Canadian Brakeshoe Co., Ltd.
Canadian Concrete Appliance Co.
Central Locomotive & Car Works
Dake Engine Co.
Dominion Lime Company
Dore & Fils
Dull Co., Raymond W.
Erie Iron Works
General Car & Mach. Works
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
Hepburn & Co., J. T.
Honig & Mock
Hopkins & Co., F. H.
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Jenckes Machine Company
Koehring Machine Co.
Lecky & Collis
Marsh & Henthorn
McKinnon Chain Co.
Mills Bros.
Morris Machine Works
Municipal Engineering & Contracting Co.
Montreal Locomotive Works
Mussens Limited
Parsons Company, G. W.
Radigan Company, John
Railway Contractors Supply Co.
Royce Limited
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Schell Foundry & Machine Co.
Stinson-Reeb Builders' Supply Co.
Sudbury Construction & Machinery Co.
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Tiffin Wagon Works
Wettlaufer Bros.

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Orpen Conduit Co., Ltd.
Ric-wiL Underground Pipe Covering Company

Contractors' Barrows
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Contractors' Flare Lights
Sudbury Construction & Machinery Company

Conveying Machinery
Goodwin, Barsby & Co.
Sturtevant Co. of Can., Ltd., B. F.
Sutcliffe, Speakman & Co.
Weller Mfg. Company.

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W. D. Beath & Son
Browning Company
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert
Northern Crane Works
Rock & Power Machinery, Ltd.
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Royce Limited

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Cabot, Inc., Samuel

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Lecky & Collis
London Concrete Machinery Co.
Mussens Limited
Rock & Power Machinery
Sutcliffe, Speakman & Co.
Wettlaufer Bros.

Culverts
Pedlar People

Cupolas (Foundry)
Northern Crane Works

Cylinders for Liquified Gases
Mannesmann Tube Company

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Aikenhead Hardware Limited
American Hoist & Derrick Co.
Beath & Son, W. D.
Hepburn, John T.
Sasgen Derrick Company

Dredges
Beatty & Sons, M.
Browning Company
Morris Machine Works

Drills
Beatty & Sons, M.
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis
Star Expansion Bolt Co.

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 12)

Vandervoort Street, North Tonawanda, N. Y.
Paved in 1909 with Bessemer Block

Building Good Streets

Many cities have tried the many patent pavements on the market only to eventually use Bessemer Block. The reason is that patent compositions are uncertain and rely too much on the personal supervision of preparation and laying.

Bessemer Wire-Cut-Lug Block

is made from a high-grade shale vitrified into a tough, durable substance. Wears longer than any other known road-paving—four inches of actual wearing surface. Lowest maintenance cost. Offers least traction resistance. Ideal for heavy loads. No mud or greasiness. Dustless and sanitary. Real estate values go up on a Bessemer Block road—the road that is there long after the long-time bond is paid.

Ask us for full information and details of Bessemer paved roads that have been giving excellent service for years past.

We guarantee quick delivery on all orders

Bessemer Limestone Company

Manufacturers of Bessemer Repressed and Dunn Wire-Cut-Lug Paving Block

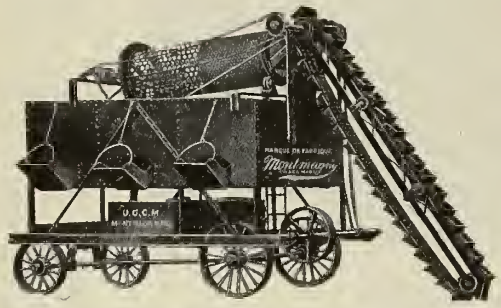
Youngstown ∴ Ohio

CANADIAN AGENTS { G. W. Essery, 47 Yonge Street Arcade Building, Toronto, Ontario
Stinson-Reeb Builders Supply Co., Montreal, Quebec

General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

Head Office and Works



"Montmagny" Portable Steel Bin.

Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

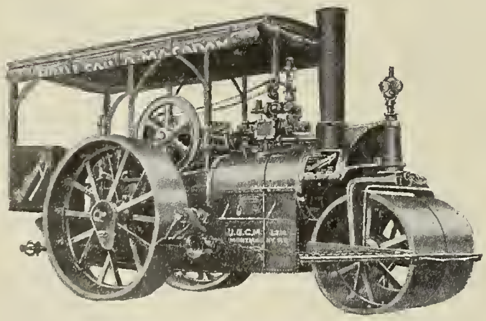
"Montmagny"

Machinery

MODERN ROAD BUILDERS

The only firm in Canada specializing in Road Machinery and making the whole outfit.

WRITE US FOR CATALOGUE



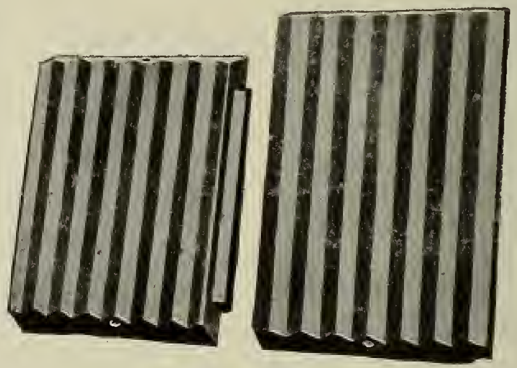
"Montmagny" Steam Road Roller.

Road Roller

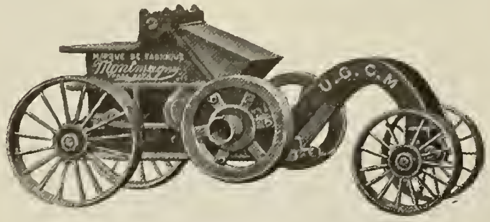
Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature
"Power Steering"



"Montmagny" Manganese Steel Jaw Plates



"Montmagny" Stone Crushers.

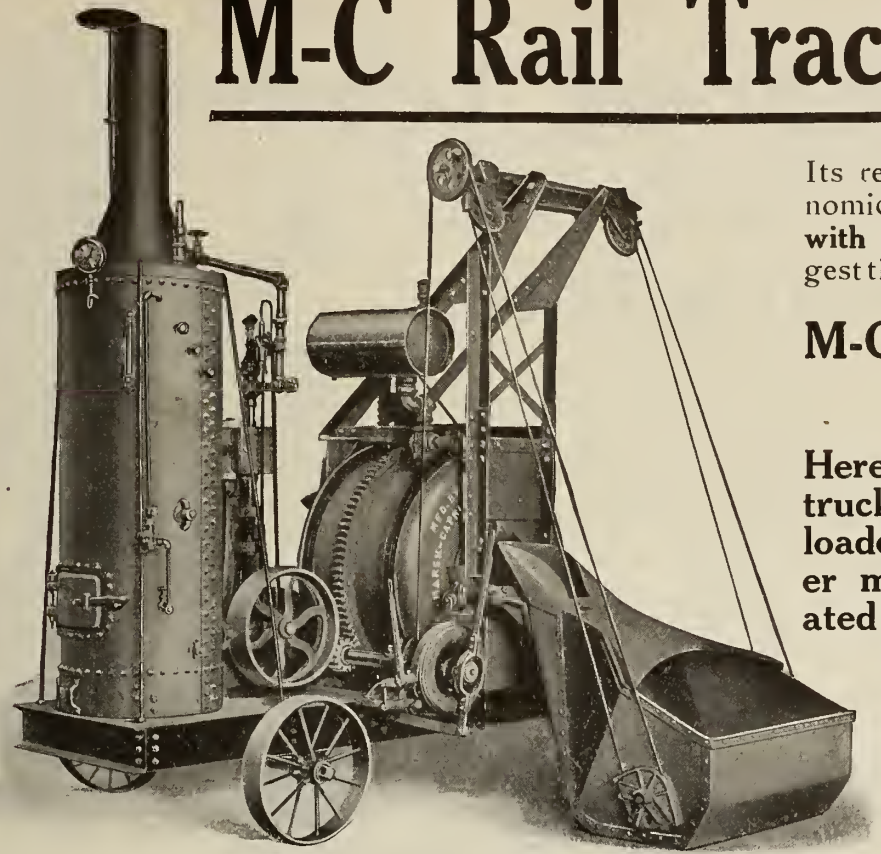
Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

Jaw Plates

For crushing field stone, granite, etc., "Montmagny" jaws are made of manganese steel. They stand the wear. For softer rock, chilled charcoal iron jaws are used. They are less expensive. Jaws may be reversed to wear both ends.

M-C Rail Track Mixer



Its reputation for lasting, economical service—"**most mixing with least fixing**"—is the biggest thing to remember about the

M-C RAIL TRACK MIXER

Here it is—mounted on trucks, with elevating side loader and automatic water measuring tank; operated by steam engine.

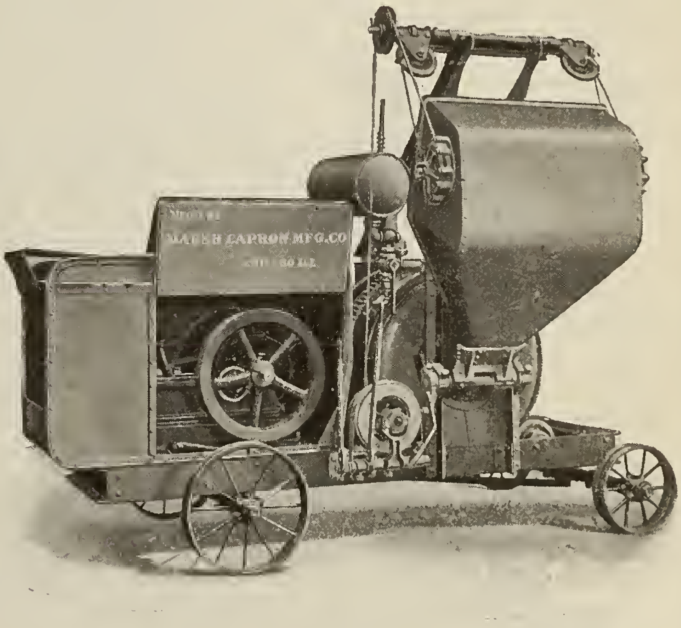
The all steel rail tracks around the drum, the segmental drum gear, the roller-bearing wheels of chilled semi-steel, the semi-steel drum of great strength and toughness, the heavy steel channel frame, the M-C friction clutch are some of the construction features of this machine which will end your mixer troubles.

The two illustrations show you M-C Rail-Track Mixers operated by steam and gasoline power.

This mixer is built in five sizes, with capacities of ¼, ⅓, ½, ¾ and 1 cu. yard of concrete per batch.

Capacity 6 to 27 cu. ft. of mixed concrete, or 9 to 40 cu. ft. of loose material per batch.

We suggest that you find out more about the machine illustrated here before you buy any mixer.



CANADIAN FAIRBANKS-MORSE CO., Ltd.

Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

Manufactured by

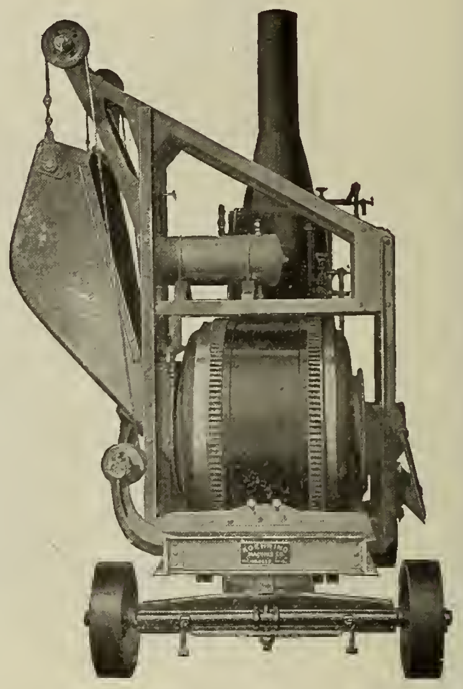
Marsh-Capron Mfg. Company

465 Old Colony Bldg., CHICAGO

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.



KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

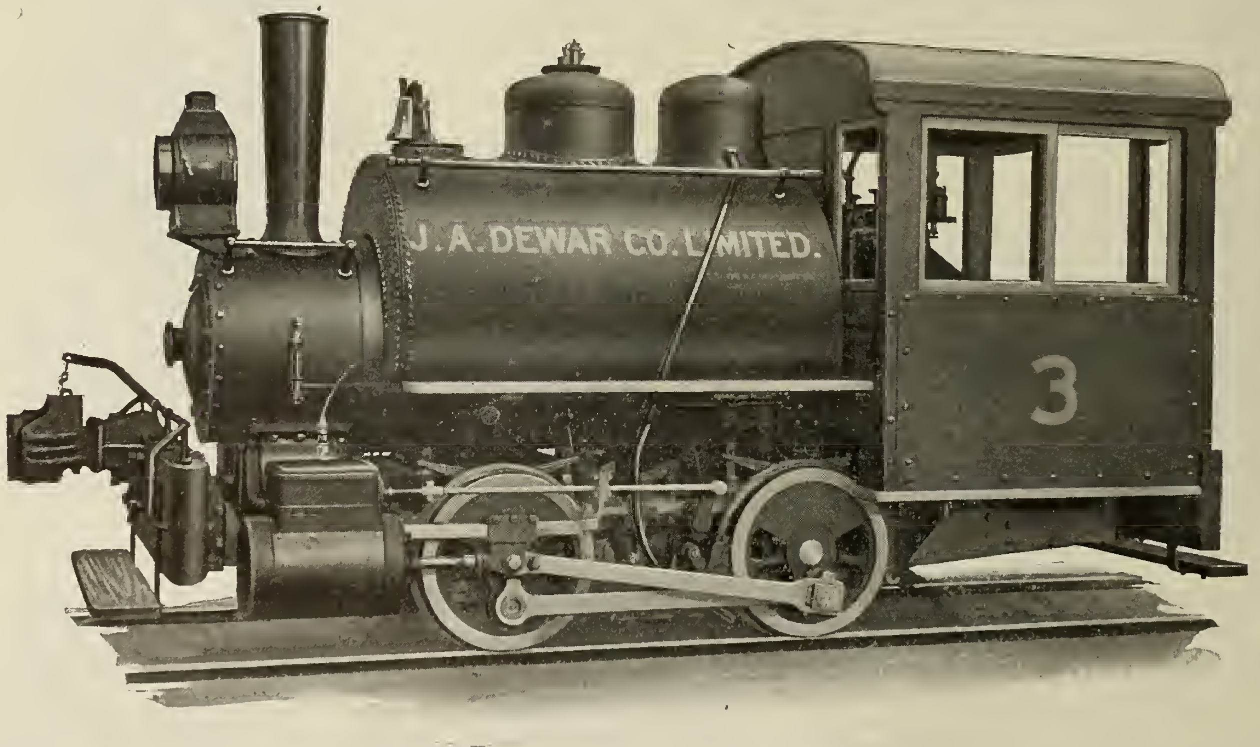
These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

Standard Hoisting Engine

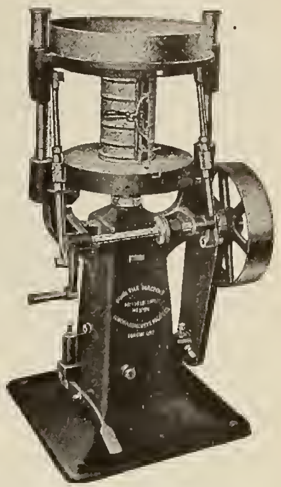
The London Concrete Machinery Co., Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES :
WINNIPEG—565 Portage Ave.—W. H. Rosevear, Manager.
CALGARY—622 9th Ave. West—P. D McLaren, Manager.
TORONTO—112 York Street—G. B. Oland, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

AGENCIES
Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Port Arthur and Fort William, Ont.—Northern Agency & Equipment Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

the Largest Manufacturers of Concrete Machinery in Canada



Dunn Cement Drain Tile Machine

Concrete Mixers

—

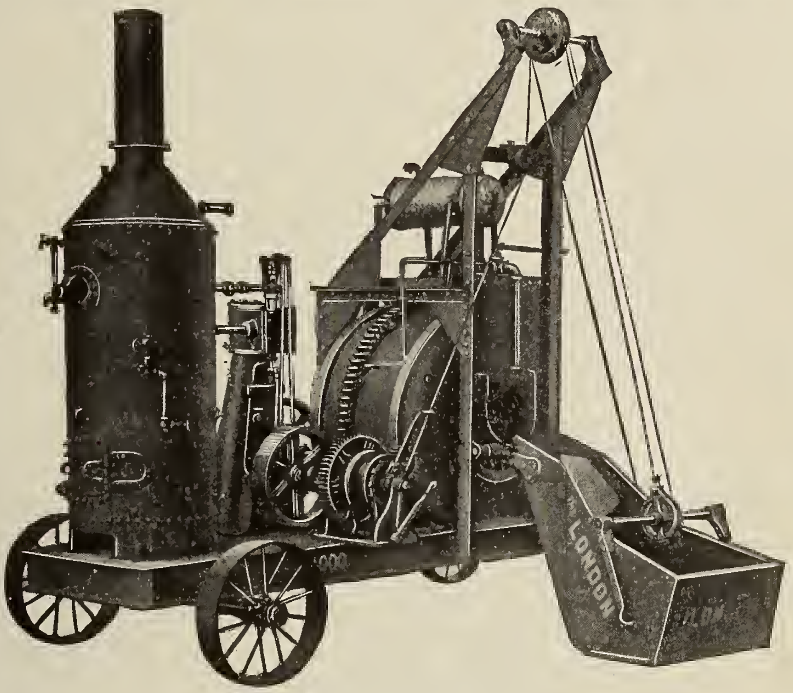
Mortar Mixers

—

Concrete Block Machines

—

Cement Brick Machines



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

—

Rock Crushers

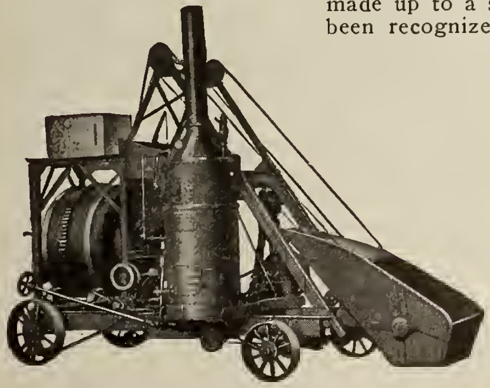
—

Pumping Outfits

—

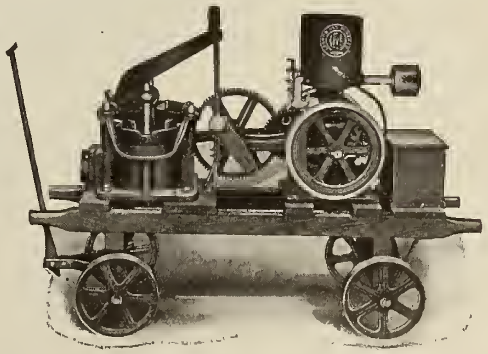
Hoists and Derricks

Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada. We also manufacture a full line of hoisting engines and contractors' equipment.



Rear Discharge Paving Machine with Forward Loader.

Correspondence Solicited.



Diaphram Pump with Power

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Drop Forgings
- Canadian Billings & Spencer, Ltd.

Dump Cars, Wheels, etc.
- Bechtels Limited
- Manitoba Bridge & Iron Works
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- Sheldons Limited
- Western Wheeled Scraper Co.
- Weller Mfg. Co.

Dump Carts and Wagons
- Deere Plow Co., John
- Troy Wagon Works

Drying Apparatus
- Sturtevant Co. of Can., Ltd., B. F.

Electric Fans
- Sturtevant Co. of Can., Ltd., B. F.

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Electric Impulse Clocks
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- Waterous Engine Works Co.
- Wettlaufer Bros.

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- Chipman & Power.
- Dominion Engineering & Inspection Company
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- Tyrrell, H. G.

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- Municipal Engineering & Contracting Company
- Parsons Company, G. W.

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- Sheldons Limited

Expansion Bolts
- Star Expansion Bolt Co.

Expanded Metal
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- Pedlar People Limited

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Fuel Economizers
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Field Instruments
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Filters
- American Water Softener Co.

Filtration Plants
- verMehr Engineering Co., John.

Fire Brick
- Ontario Lime Co., Ltd.
- Smyth & Ryan

Fire Escapes
- Manitoba Bridge & Iron Works
- McGregor & McIntyre

Fireproof Floors
- Keystone Fireproofing Company of Canada

Fireproof Doors and Windows
- Feather & Roadhouse
- Hope & Sons, Henry
- Mussens Limited
- Pedlar People Limited
- Steel & Radiation Limited

Fuse (Safety Blasting)
- Lecky & Collis

Fixtures (Gas)
- Consumers Gas Company

Floor and Wall Tile
- Frontenac Floor & Wall Tile Co.

Folding Doors
- Springer, O. T.

Forges
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- Sheldons Limited
- Canadian Sirocco Co.

Forgings
- Canadian Billings & Spencer, Ltd.

Gas Engines
- Armstrong Mfg. Co.
- British Mfrs. Assn. of Canada

Gasoline Engines
- Armstrong Mfg. Co.
- Mills Bros.

Glass
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- Excelsior Plate Glass Co.
- Hobbs Mfg. Company
- Luxfer Prism Company
- Pilkington Bros.
- Toronto Plate Glass Imp't'g Co.

Hammer Drills
- Canadian Ingersoll-Rand Co.

Heating Contractors
- Nobis Engineering Co.

High Pressure Pipe Lines
- Boving Company of Canada
- Escher Wyss & Co.
- Mannesmann Tube Company
- Pittsburgh Valve, Foundry & Construction Company

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- Beatty & Sons, M.
- Browning Company
- Brown Hoisting Machinery Co.
- Canadian Allis-Chalmers, Ltd.
- Canadian Fairbanks-Morse Co.
- Canadian Ingersoll-Rand Co.
- Jenckes Machine Co.
- Hopkins & Co., F. H.
- Lecky & Collis
- Marsh & Henthorn
- Morris Hoist & Crane Co., Herbert.
- Mussens Limited
- Rock and Power Machinery
- Royce Limited
- Sturtevant Co. of Can., Ltd., B. F.

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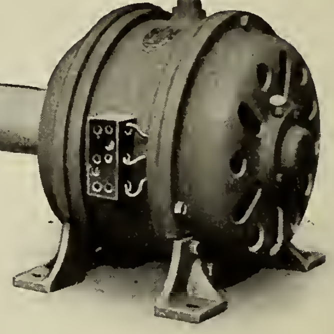


We have in stock a complete range of

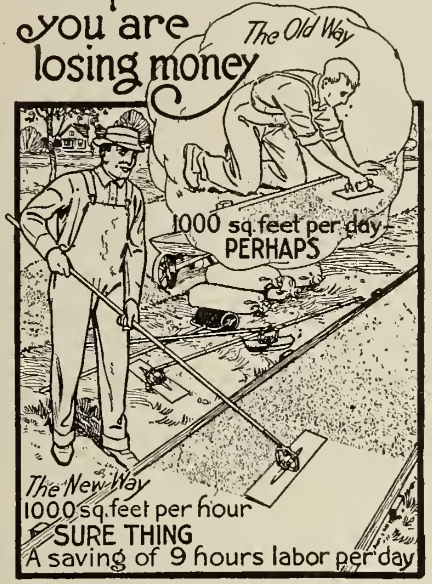
Single Phase Induction Motors

25 and 60 cycles of all sizes up to 5 H.P.

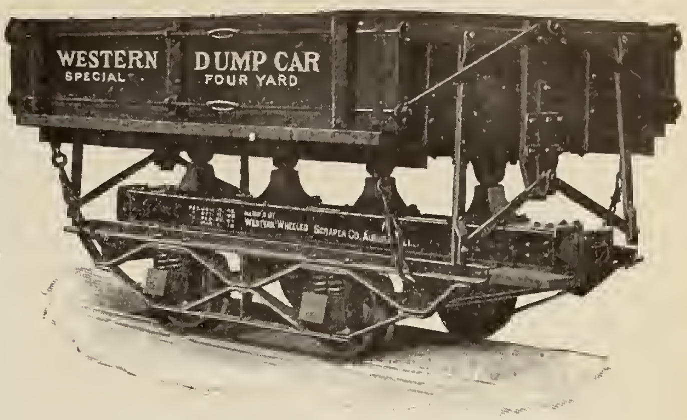
The Ferranti Electrical Co. of Canada, Ltd.

Head Office:—90 Sherbourne St., TORONTO *Branches:*—704 Unity Bldg., MONTREAL
Farmers Advocate Bldg., WINNIPEG

If you are not using
"ABRAM"
TOOLS
It is plain to be seen
you are
losing money



Abram Cement Tool Co.,
Windsor, Ontario



The Western Four-Yard Car

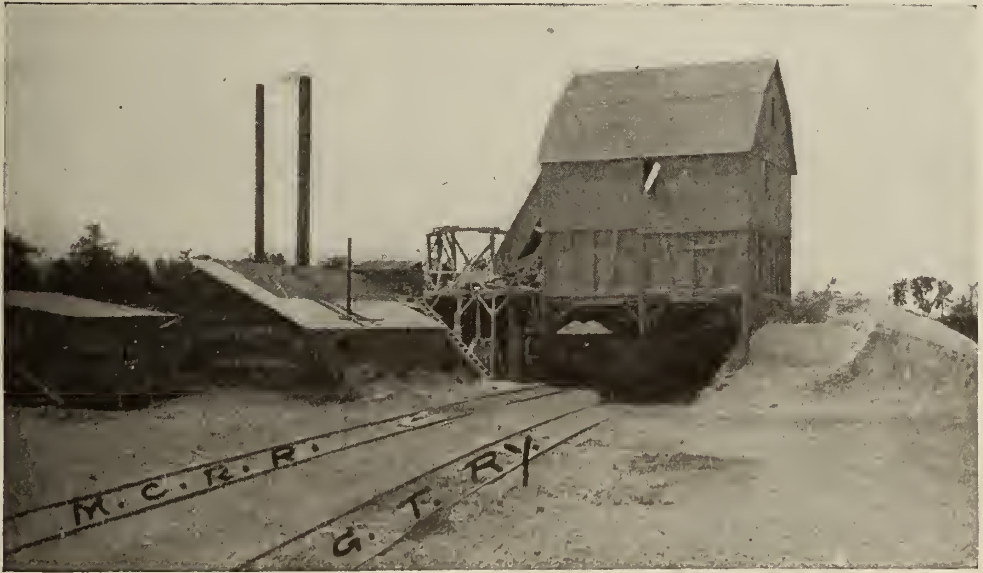
by reason of its strength at every point of resistance, is beyond competition.

The sterling qualities of the Western Standard 4-yard Car are responsible for its high standing with men engaged in the handling of earth and stone. Many thousands of these cars have been sold and are used on the most important earth moving projects of the age.

The Western Special 4-yard Car, our most recent product, is designed for even harder service than the Standard Car, and we urge those desirous of securing cars of great strength to make a careful examination of this car.

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads



must be built of a
Tough Stone
that will cement
WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Co.
Sheldons Limited

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Northern Crane Works
Stratford Mfg. Company

Hoisting Engines
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.

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Canada Iron Corporation
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Kerr Engine Company

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Central Locomotive & Car Works

Insulating Compounds
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Interior Finish and Doors
Batts Limited
Canada Office & School Fur. Co.
Rhodes Curry & Company

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Canadian Allis-Chalmers, Ltd.
Canadian Locomotive Company
Montreal Locomotive Works
F. H. Hopkins Company
Mussens Limited

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Metal Lath
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Pedlar People Limited.
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Mechanical Draft Apparatus
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Meters, Water
Hopkins & Co., F. H.
McDougall Caledonian Iron Wks
Neptune Meter Co.
Peacock Brothers
Siemens Co. of Canada, Ltd.

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Asphalt & Supply Co.
Aztec Oil Asphalt Co.
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Baker Co., R. D.
Barber Asphalt Paving Co.
Dominion Creosoting Company
Dunn Wire-Cut-Lug Brick Co.
Ontario Asphalt Block Co.
Paterson Mfg. Co., B.

Pipe (Concrete, Iron and Wood)
American Spiral Pipe Works
Canadian Allis-Chalmers, Ltd.
Canadian Pipe Co.
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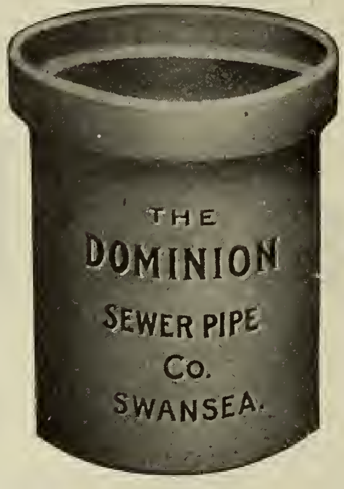

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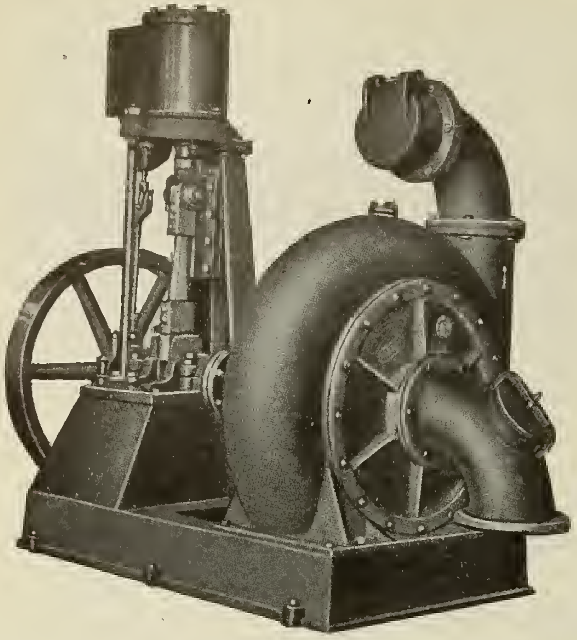

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Sewers and Culverts

properly built of properly made

Reinforced Concrete Pipe

LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS.
NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

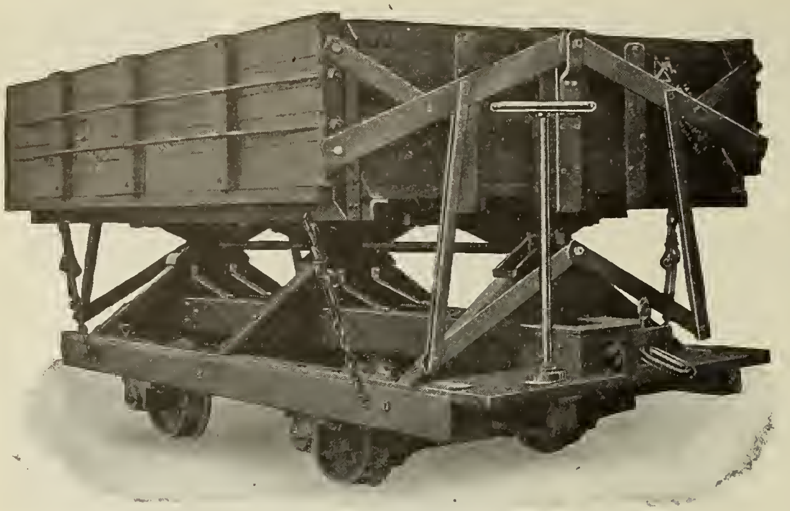
STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application

Dominion Concrete Company Ltd.

Kemptville, Ontario



Cut showing 4 and 6 yard Double Diamond Steel Frame Side Dump Car. The best yet.

We introduce to the contracting trade our new steel frame cars. We assure you here is value for your money. Nothing hasty about the design, but a careful sifting of really desirable features required. We ask that you write us for specifications and full particulars. Better value never offered.

GLENGARRY

Something New in
Steel Frame Cars

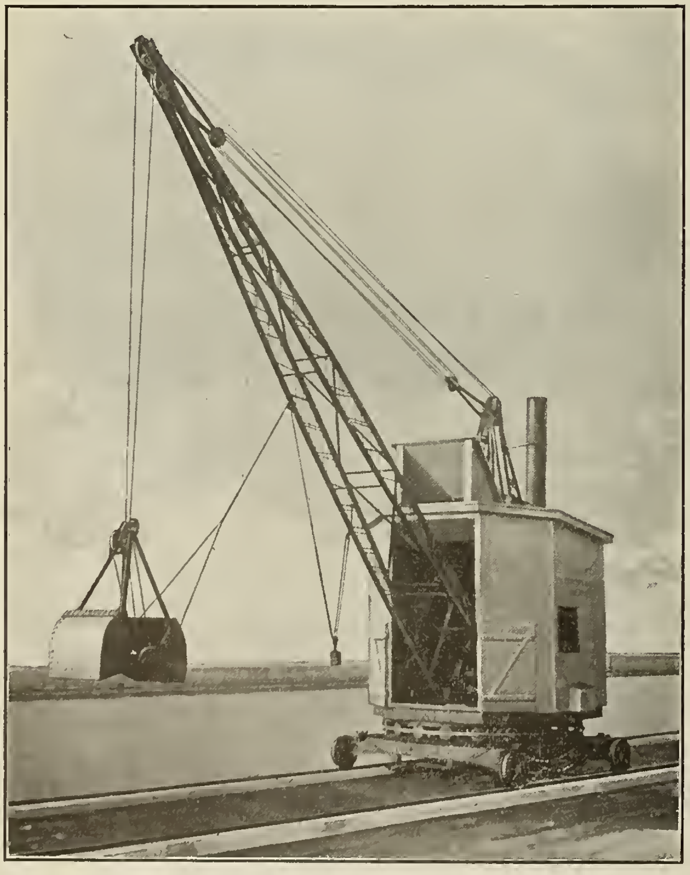
Here is our new double diamond steel frame car. Has more advanced improvements than all competitors.

FEATURES

Shorter diamonds; stiffer frame; angle over diamonds; perfect trussing of frame and drawbars; removable box carried on heavy rod full length—no pins. Stronger and stiffer box having wonderful underframe support. Doors reversible, steel bound, double trussed. Perfect door action. Strong simple irons. In short, has the best points claimed by competitors, with many improvements added.

Watch next week's issue.

The Schell Foundry and Machine Company, Limited
ALEXANDRIA - - - - ONTARIO



For Economical Loose Material Unloading

use a

BEATTY

Travelling and Revolving Derrick

Fitted with a
"FAIVRETTE" TYPE "C"
Clamshell

Our 1914 catalogue illustrates and describes BEATTY HOISTS. Excavating and Handling Equipment for use on land and water.

M. BEATTY & SONS
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Established 1862

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H. W. Petrie, Limited, Toronto
E. Leonard & Sons, St. John, N. B.
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KAHN SYSTEM

OF REINFORCED CONCRETE

Steel Sash
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KAHN SYSTEM Reinforced Concrete

Concrete Finishes
Water-proofing Pastes

STEEL FLORETYLE
FOR LONG SPAN CONSTRUCTION

Trussed Concrete Steel Co.
of Canada Limited
Head Offices and Works: Walkerville, Ont.
Branches Everywhere

Central Locomotive & Car Works

Largest Rebuilders of Railroad and Contractors equipment in America. Operate Two Extensive plants near Chicago. Have filled Large Orders of Equipment for Canadian Contractors.

We carry in stock **Locomotives of all types, Flat Cars, Center, Side** and **Air Dump Cars, Box** and **Gondola Cars.** Can make Prompt Deliveries. Prices Low.

Write for Specifications and Quotations on anything you need.

Central Locomotive & Car Works
410 Fisher Building Dept. S
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$45. GARROW

Contractors Acetylene Flare Light

The great feature of this new light is strength and simplicity. The light is constructed of steel assembled by the Oxyacetylene Welding Process and consists of three parts. It is made to stand the roughest handling by unskilled labor without injury. A distinct advantage of the Garrow Light is its use in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame.

$45.00 F. O. B. Sudbury

The
Sudbury Construction & Machinery Co., Ltd.
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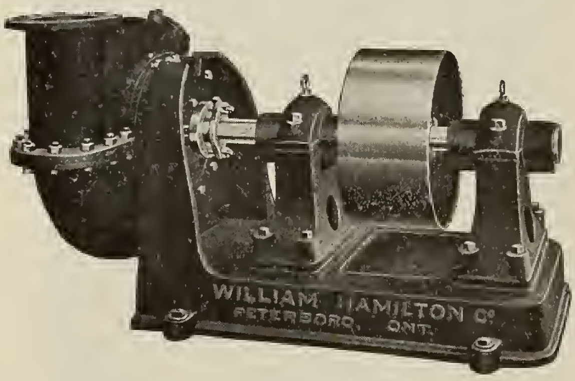


Contractors' Pumps

These pumps have been specially designed for contractors' use. They are made for belt, direct engine or motor drive.
They have special features not found in any other pumps, notably the horizontally split shell and the wide spacing between pulley and bearings.
They are built in all sizes from 2-in. to 14-in. discharge.
Ask for pump bulletin.

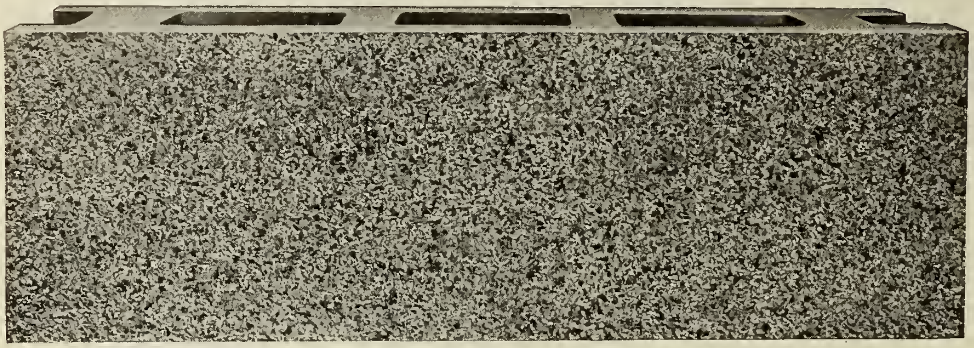
William Hamilton Company
Peterborough, Ontario

Zagelmeyer System

OF CASTING

Hollow Cement Building Blocks

With Granite Faces



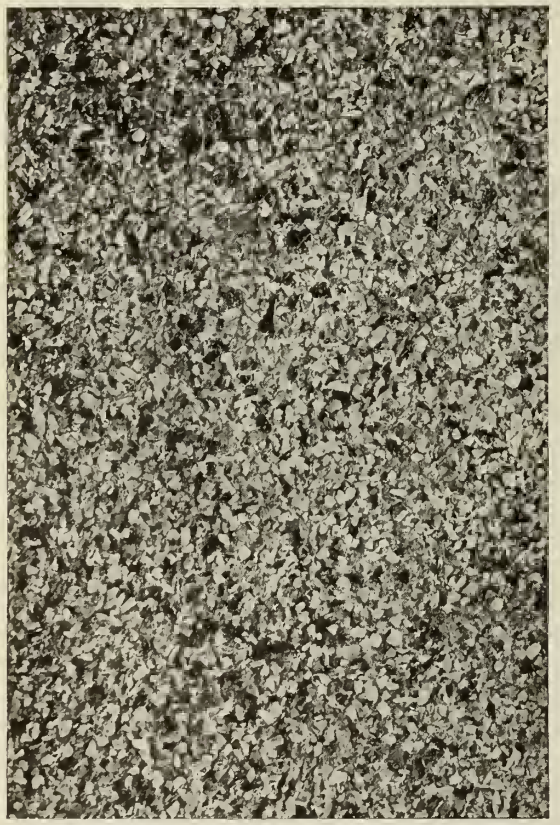
They cost less

They sell for more

You sell more of them

8 x 8 x 24 inch Granite Smooth Face Block

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



Enlarged View of Granite Smooth Facing

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold or moisture.

8 x 8 x 24 inch Granite Rock Face Block

Send us fifty cents and we will send, freight prepaid, to any point in Ontario, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

MR. BLOCK MAKER:—

What show will you have if your competitor secures the exclusive right for this system in your city?

MR. CONTRACTOR:—

Get into a business that is protected. Then you will make money.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Canadian Zagelmeyer Co.

Limited

11 Howard Ave., Windsor, Ontario

WELL DRILLS are not BLAST-HOLE DRILLS

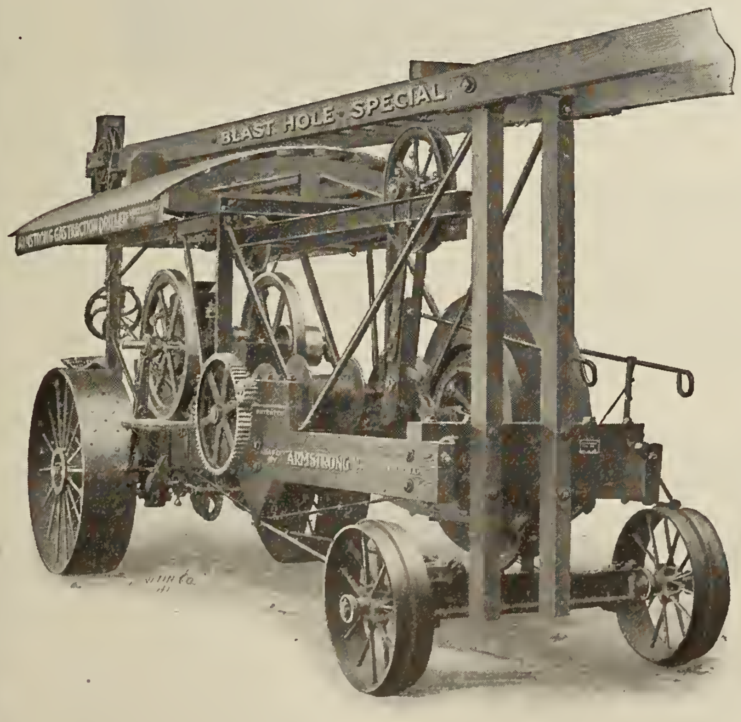
This is an age of specialization—Contractors and Quarry Operators who use Armstrong Special Blast-Hole Drills do so because the "Armstrong Special" is designed exclusively for drilling BLAST HOLES—NOT WELLS.

"Armstrong Special" Blast-Hole Drills are not well drills. We build well drills and have been since 1867, but we know, as do scores of successful contractors and quarry men, that well drills are not designed for and will not stand the grief of blast-hole drilling (a comparison of machines which have been in operation for a reasonable period of time will convince you). Behind our knowledge is fifty years of drill building experience—behind the experience of users is the knowledge that ARMSTRONG machines are not only more efficient but the repair, operating and "upkeep" expense is much less, due to the fact that

The Armstrong Special Blast-Hole Drill is the only Cable Blast-Hole Drill designed exclusively for Blast-Hole Drilling

That is why it accomplishes more for the Contractor and Quarryman than any machine of any other type

Every working part of the "ARMSTRONG" Special Blast-Hole Drill is designed with direct reference to hard rock drilling. The "ARMSTRONG" spudding beam —the most important feature—gives a quick, sharp, springy blow that drills more holes at less cost than any other. The "ARMSTRONG" raises the tools as fast as they drop and *does not allow the tools to rest at the bottom of the hole* as in the case of well drills.



If we can prove to you that the "ARMSTRONG" will drill blast holes cheaper and better than any other machine, you surely want to know it. All you have to do is send a postal asking for proof of "ARMSTRONG" Special Blast-Hole Drill superiority, and address today to

Armstrong
MFG. CO. WATERLOO, IOWA, U.S.A.
BUILT FOR SERVICE
SINCE 1867

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Darling & Pierson, Architects

DOMINION BANK BUILDING
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The Terra Cotta for both buildings was manufactured and set by

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Agencies in all the large cities of Canada.

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HULL, - QUEBEC

Manufacturers of

"Adamantine," Chrome and Manganese Steel Castings

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Machine - Moulded Gears up to 16 feet. Grey Iron, Semi-Steel, Brass Bronze and Aluminum Castings.

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Our Specialty

Tube Mill Feeders
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Screw Conveyer Bearings
Eccentric Hubs, Crusher Heads and Concave Strips for Gates Crushers
T. M. Revolving Feeders (new style) for Gates Tube Mills

Patterns for all these lines kept on hand.

We solicit your patronage and prompt attention will be given to tenders on above work.

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"LIQUID KONKERIT" PRESERVES AND BEAUTIFIES BRICK AND CONCRETE WALLS

"Liquid Konkerit" fills the pores and prevents the penetration of moisture, it makes old walls look like new and new walls retain their fresh appearance indefinitely.

Write for color card and instructions for treating concrete floors and walls

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DISTRIBUTORS—Black Building Supply Co., Limited, Toronto
Canadian Equipment & Supply Co., Limited, Calgary and Edmonton
Dartnell Limited, Montreal
Western Paint Co., Winnipeg

Write nearest distributor for full information.

Canadian Billings & Spencer, Limited

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TRADE MARK

Drop Forged Drift Pins
fit right and wear well

Welland, Ontario

Burlington Steel Co.
(Formerly Canada Steel Co., Ltd.) Limited

Hamilton - - Canada

STEEL BARS
for Reinforcing Concrete

Rounds, Squares, Flats, Twisted Squares,
Angles, Channels, T-Bars, Ovals, Half Ovals,
Half Rounds, Bands, Special Sections.

CROSS ARM BRACES — POLE SHIMS
Plain and Galvanized

Prompt Shipment from Stock

Why Use Expensive Pipe When Butted Tubing Will Do?

Send for prices and full particulars about our butt joint and structural tubing.
You will find it is more economical in cost than ordinary pipe and will answer every requirement for which you might buy more expensive material.

Standard Tube & Fence Co., Limited
Woodstock, Ontario
Manufacturers of
Butt Joint and Structural Tubing, Trolley Pole Arms,
Sleeves for Reinforcement Rods, Fence Posts, Woven
Wire Fence, Gates and Fence Supplies

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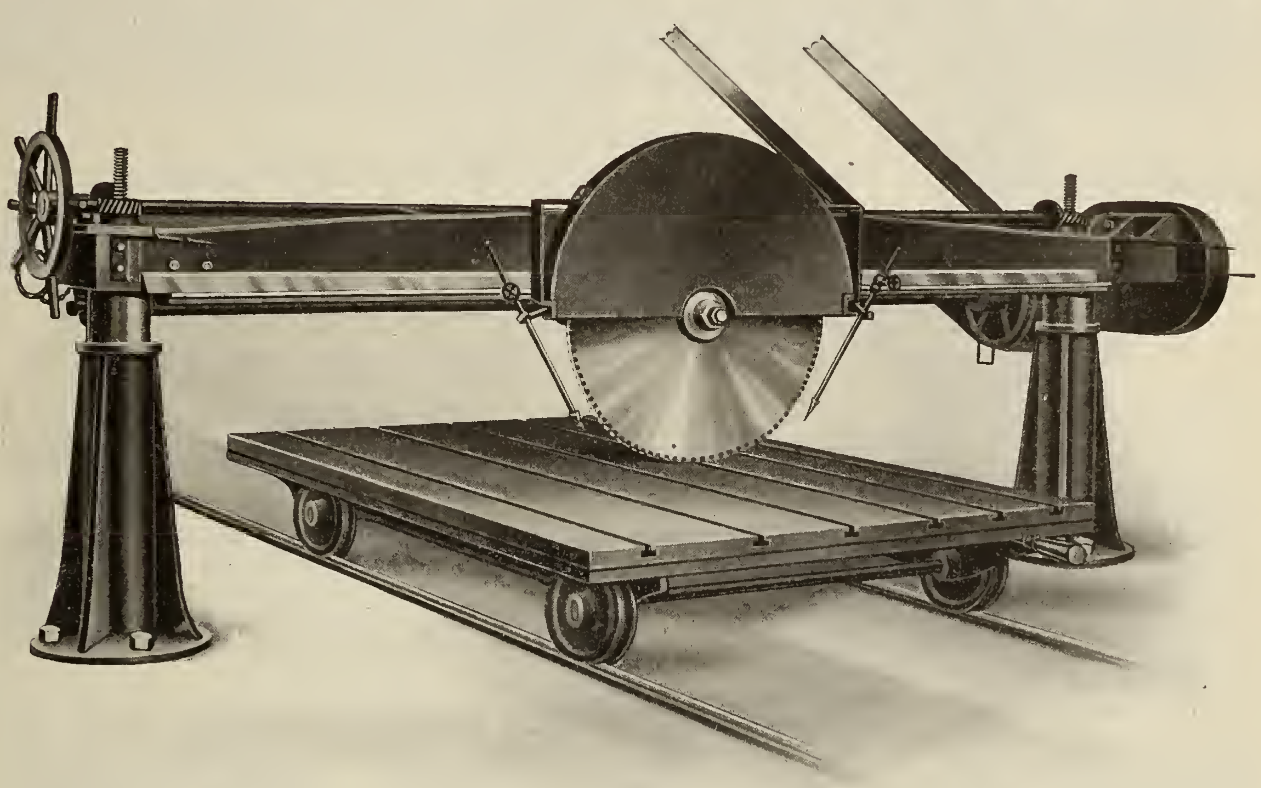
Buildings and Construction Work
OF ALL KINDS
Reinforced Concrete a Specialty

Write us for preliminary plans,
estimates and photos of our work.

247 Confederation Life Building, TORONTO, ONT.

Anderson's Coper and Cross Cut Diamond Saw

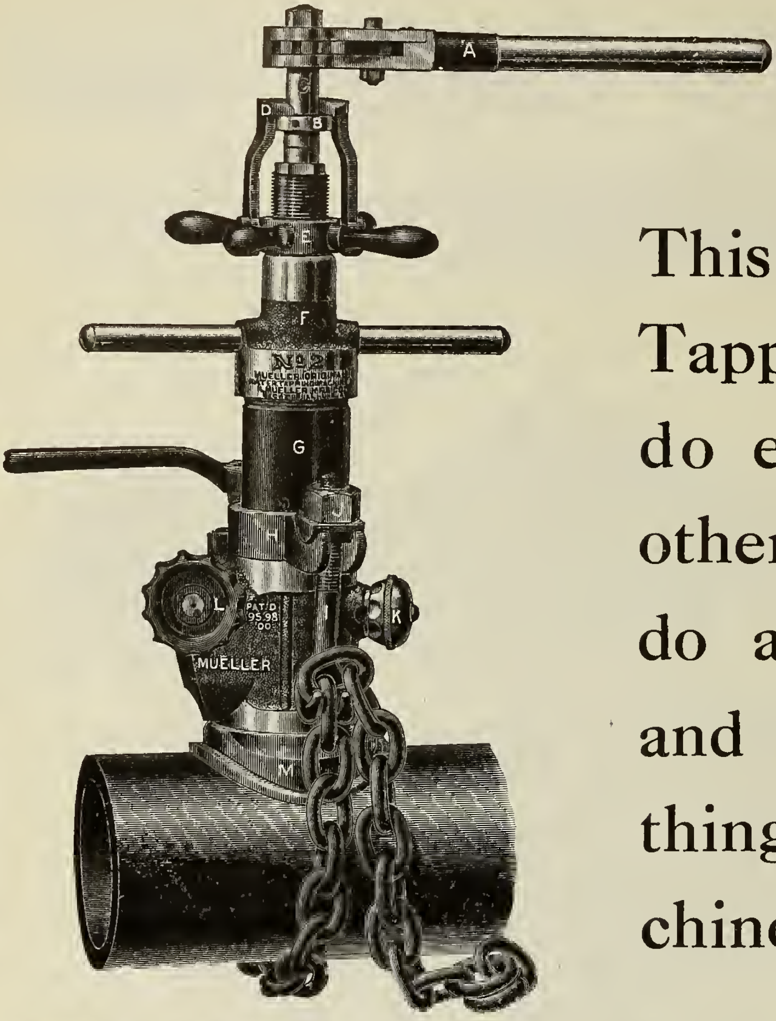


Simple of control ***Highly efficient***

Copes Marble, all four sides with one setting. Top part of table revolves and has notches for Hexagons, Octagons, as well as Squares.

Can be changed from Coper to Diamond saw in few minutes.

George Anderson & Co. of Canada, Ltd.
617 Quebec Bank Building, MONTREAL



This Mueller Water Tapping Machine will do everything any other Machine will do and do it better, and will do many things no other machine can do.

MUELLER

Water Tapping Machines have an established reputation of enduring service—25 years on the job and still good. One user says:

"We have used a Mueller Machine 26 years, making over 1,000 taps, so you see the machine does not owe us anything."

Thousands of Mueller Machines in use and never a one that has not given entire satisfaction. It is the ONLY machine to buy, and you'll never have to buy but one. It will outlast anything about the plant.

Clip and mail the coupon.

C. R.

**H.
Mueller
Mfg. Co.
Sarnia, Ont.**

Send me descriptive literature and prices on tapping machines

Signed ....

City........ .... *State*...................

"Made in Sarnia, Canada"

H. Mueller Mfg. Co., Limited

SARNIA, ONTARIO

Makers of High Grade Water Plumbing and Gas Brass Goods

SPECIFY!

Enamel Concrete Brick

The brick that IS a brick. Absolutely true in every detail. Perfect in shape, color and durability.

WATERPROOF! FIREPROOF!

A brick that will stand the test, a perfect material, perfectly made, at the most modern BRICK Plant on the American continent to-day.

Quotations upon request.

The National Builders' Supply & Enamel Concrete Brick Co., Limited
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High Calcium Lime

Manufactured by

The Dominion Lime Company,

SHERBROOKE, - - PROVINCE OF QUEBEC

Its Special advantages are:

Strength,
Whiteness,
Purity

Builders admit that our Lime takes more sand and is therefore cheaper to use.

Shipped in Bulk or Barrels.

Will give 25% better results to CONTRACTORS, PAPER MANUFACTURERS and OTHERS, than the ordinary lime.

J.O.B. CONTRACTORS PUMPS

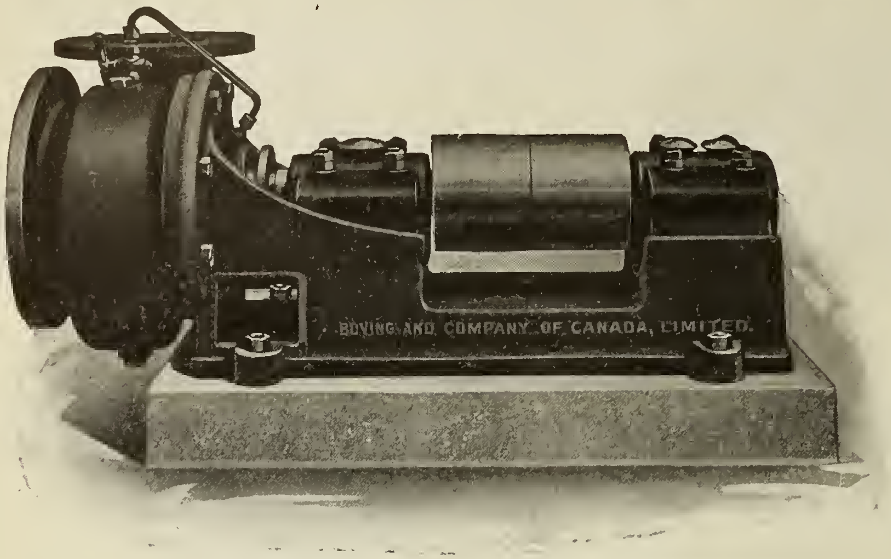

Illustration shows 10″ Contractors Pump.

Belt Driven Low Pressure Pumps of Solid and Durable Design — Built for Heavy Duty.

Let Us Quote on Your Requirements

Pumps for all purposes
Belt Driven
Direct Connected
High, Medium and
Low Pressure

Boving & Co. of Canada Limited

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Rosebery says:
"INTERNATIONAL"
in the end—why not now?

Considering mixer ability, strength, life and output—

You will be interested in our latest Catalogue M 60-98

These improvements have placed the—

INTERNATIONAL Concrete Mixers

—on a plane above them all

Built for Every Job

Globe Drum — Semi-Steel, Correct and rapid Mixing Principle.

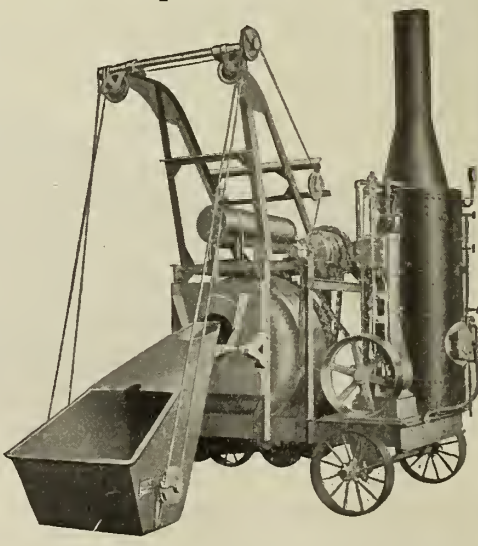
Chain Drive—No gears, no lost power, no noise.

Self-Oiling Tracker Wheels—No grease cups, oil only twice a month.

Self-Oiling Winding Drum—Simple, sturdy and easily operated.

Steel Tracker Bands—Eliminating all possibility flat bands, breakage, etc. Added life to the drum.

10 sizes, 4 to 100 cu. ft. per batch any power.
Street Pavers, 3 sizes, 9-12-20 cu. ft.



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M296.4

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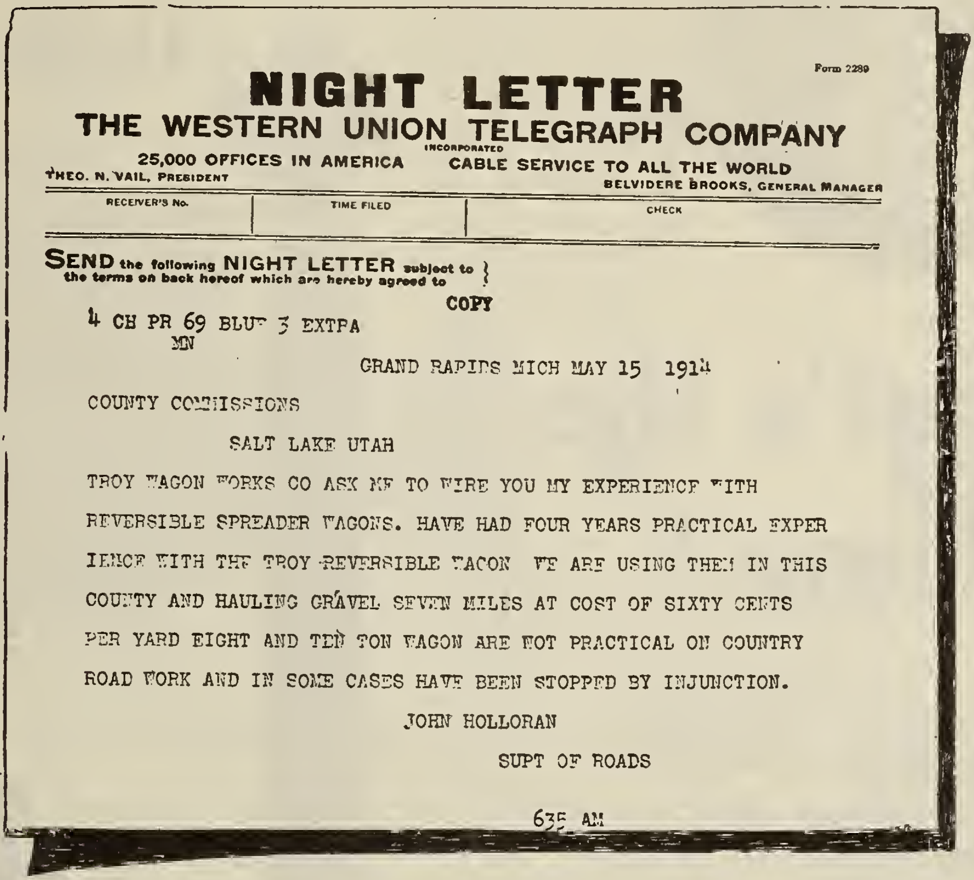
Hauling Gravel 7 Miles At A Cost of 60 Cents A Yard



Form 2289

NIGHT LETTER

THE WESTERN UNION TELEGRAPH COMPANY

INCORPORATED

25,000 OFFICES IN AMERICA CABLE SERVICE TO ALL THE WORLD

THEO. N. VAIL, PRESIDENT BELVIDERE BROOKS, GENERAL MANAGER

RECEIVER'S No.	TIME FILED	CHECK

SEND the following NIGHT LETTER subject to the terms on back hereof which are hereby agreed to

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GRAND RAPIDS MICH MAY 15 1914

COUNTY COMMISSIONS

SALT LAKE UTAH

TROY WAGON WORKS CO ASK ME TO WIRE YOU MY EXPERIENCE WITH REVERSIBLE SPREADER WAGONS. HAVE HAD FOUR YEARS PRACTICAL EXPERIENCE WITH THE TROY REVERSIBLE WAGON WE ARE USING THEM IN THIS COUNTY AND HAULING GRAVEL SEVEN MILES AT COST OF SIXTY CENTS PER YARD EIGHT AND TEN TON WAGON ARE NOT PRACTICAL ON COUNTRY ROAD WORK AND IN SOME CASES HAVE BEEN STOPPED BY INJUNCTION.

JOHN HOLLORAN
SUPT OF ROADS

635 AM

With Troy Reversibles

That is, at a cost of just a trifle over 8½ cents per yard mile.

How much would a similar haul cost **YOU?** Or let's look at it an other way—in **ton miles.** Where the job is a big one, Troy Reversibles deliver material at never more than 10 cents per ton mile.

To make this statement good, we will submit the users' figures, compiled on the job in practically any section of the United States.

If reducing your big hauling costs to absolute **minimum** interests you, just send for Hauling Book 2 R.

THE TROY WAGON WORKS CO.

N. Market St., TROY, OHIO

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There would be no argument on this subject if the "PULSYNETIC" Electric Clocks were installed.

They are invariably correct because they depend on the unvarying force of gravity.

Accurate and uniform time is shown throughout any building in which they are installed.

Easily fixed, no winding and no skilled attention is required.

Send for Book No. 5

which contains fullest information about all classes of Electric Clocks.

GENT & CO., Ltd.
Leicester, England

KERR

Hydrants
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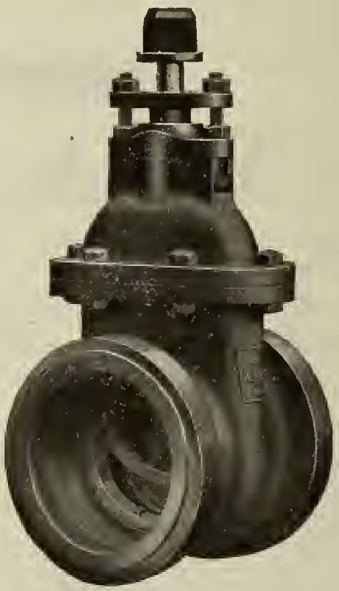
Gate Valves

are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of waterway, and are strong, compact and modern in design and construction.

Standard Compression Hydrant



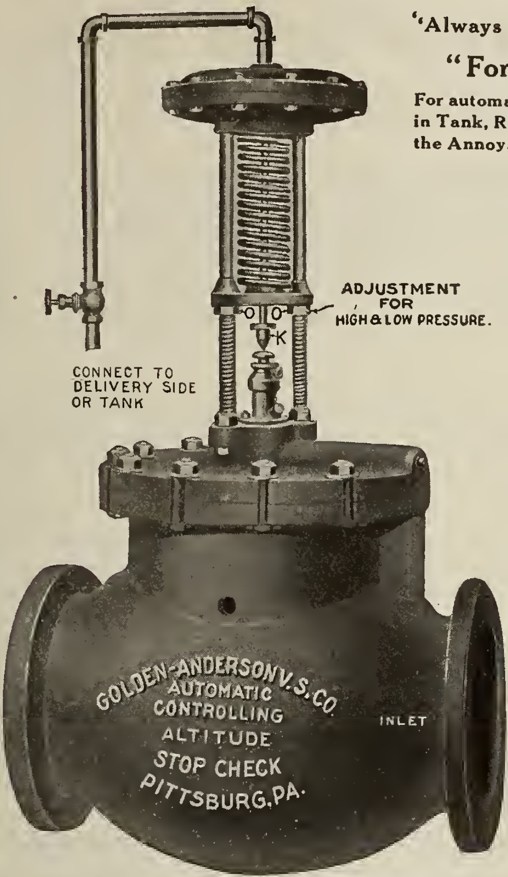
6″ Hubbed

Send us your Specifications and Enquiries.

Prompt attention given.

THE KERR ENGINE CO.
LIMITED
WALKERVILLE, ONT.

The Golden-Anderson Pat. Cushioned Controlling Altitude Valves

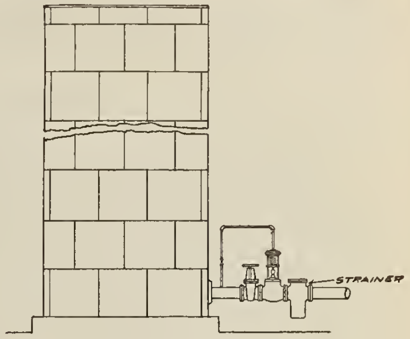


"Always Cushioned in Opening and Closing"

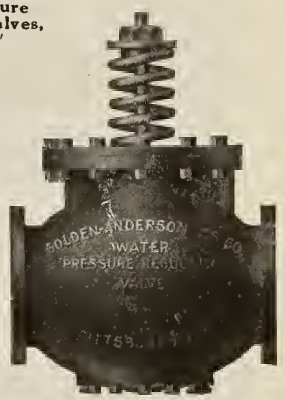
"For High and Low Pressure"

For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.

Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.



Automatic Cushioned Water Pressure Regulating Valves, up to 24"



Golden-Anderson Float Valves

(Angle or Straight Way), up to 24"

Golden-Anderson Valve Specialty Co., 1247 Fulton Bldg., Pittsburgh, Pa.

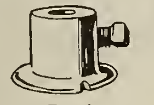


Fig. 1

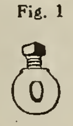


Fig. 2

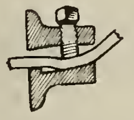


Fig. 3

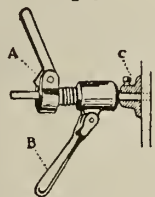


Fig. 4

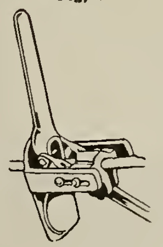
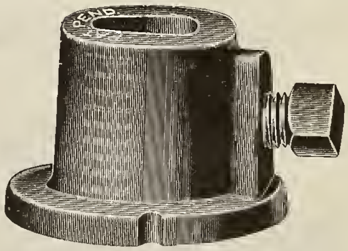


Fig. 5

Use UNIVERSAL CLAMPS

to convert any round rod into a bolt



Long bolts—removable bolts—bolts extending through timber and poured concrete—these are best for form work.

The Universal Form Clamp converts round rods of any size into threaded bolts with removable heads and adjustable nuts.

Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section. showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screw is tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

One Clamp for walls, columns and soffits This clamp is literally *universal* in application. With these low cost cast iron clamps and various lengths of steel rods, forms may be held rigidly in place during the entire process of building.

Write for circulars and prices. We'll send a sample clamp for 10c. to pay postage and packing.

Universal Form Clamp Co.

Sole Representatives for Ontario and Eastern Canada:

Railway Contractors Supply Company

504 Standard Bank Bldg., Toronto

Universal Form Clamp Co., 504 Standard Bank Bldg., Toronto

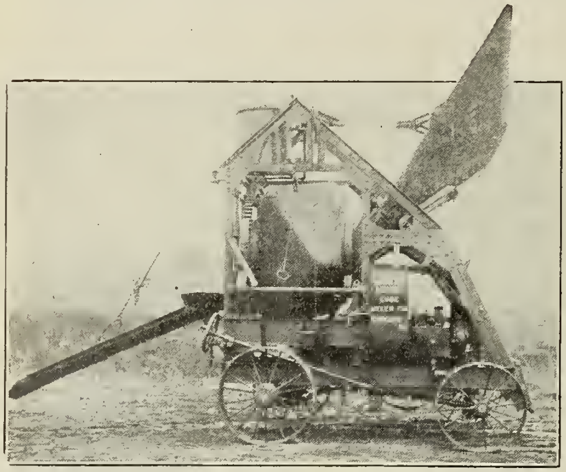
I enclose 10c. Please send me a sample Universal Clamp.

Name ....

Address ....

The Austin Improved Cube Special Street Paver

One-man Operated **Rapid Working**



All levers are within reach of just one operator. All levers are actually within a three-foot circle. The operator touches the lever that causes the machine to discharge, another that operates the big, rapid-moving loading skip, another lever still that closes the door at the discharge-end that prevents slopping of concrete.

It has a 10-foot chute that swings on a pivot and covers a range of nearly 22 feet without moving the machine. This chute has hinged sections three feet apart, which makes it possible to place concrete at any desired point within reach.

Built in two sizes—13½ and 22½ cu. ft. of loose material. Can furnish with either gasoline or steam power.

Write to our Canadian Representatives

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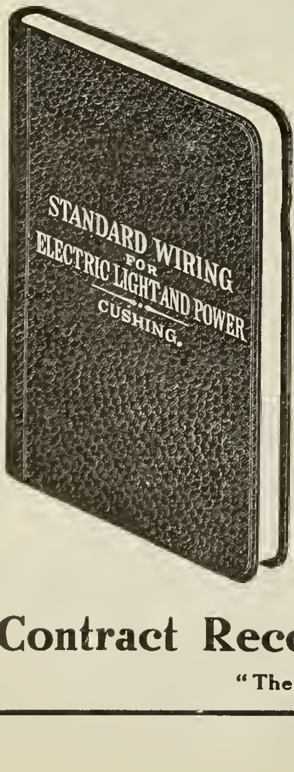

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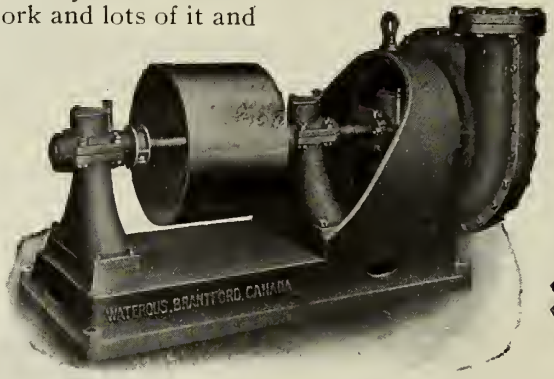

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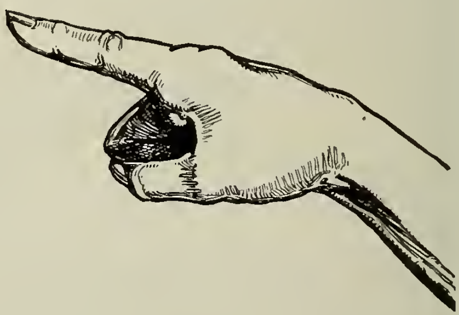

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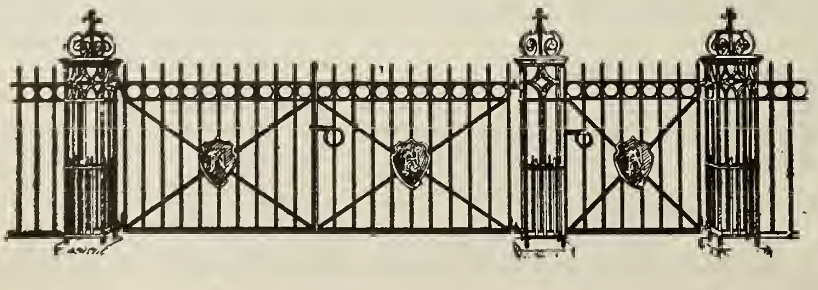

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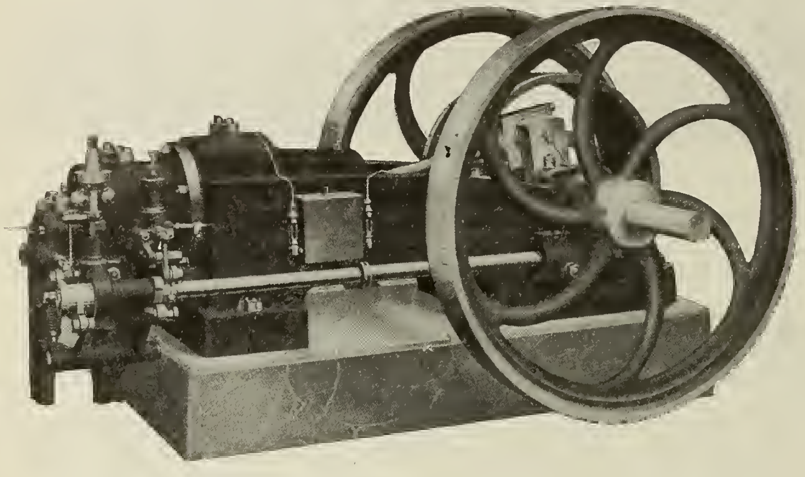

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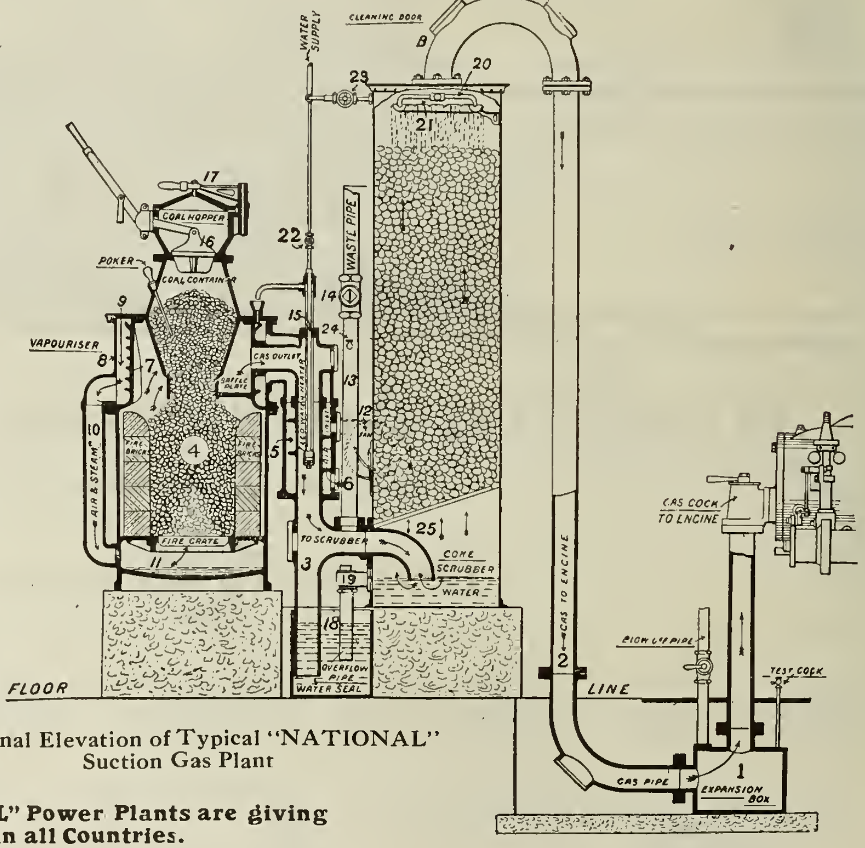

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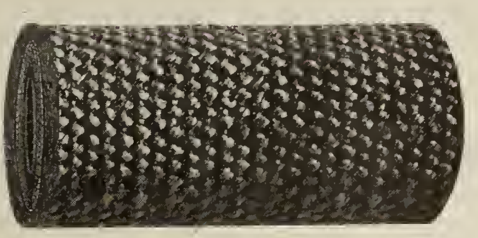

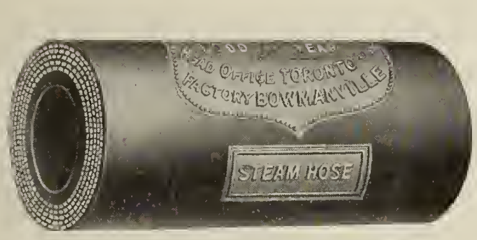

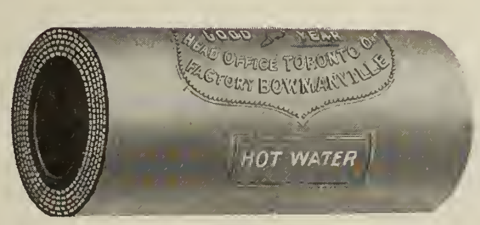

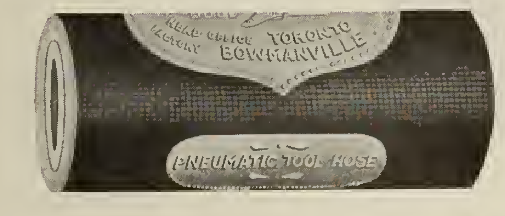

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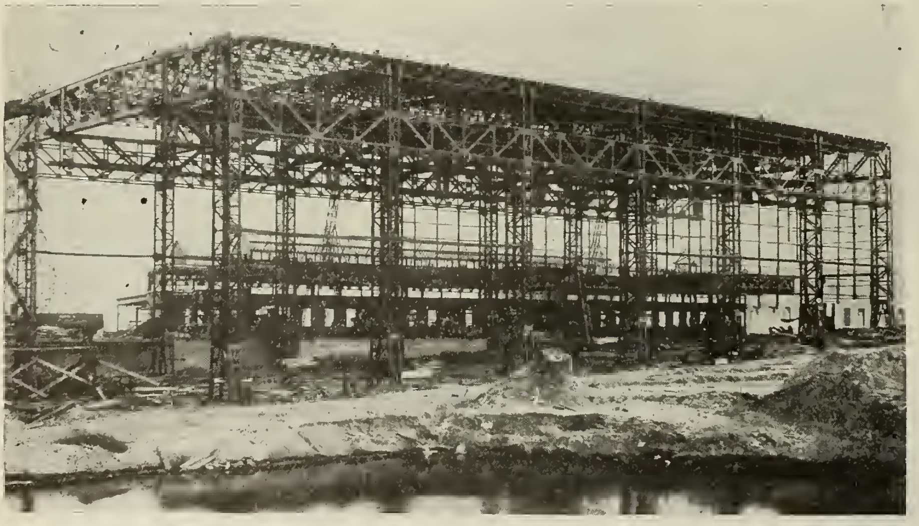

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Canadian Constructional Centres —A Criticism

ONE of our correspondents favors us with a few acceptable, if somewhat belated, remarks upon the feature "Canadian Constructional Centres" which appeared recently in our columns. His communication is certainly complimentary in so far as what he kindly terms our enterprise is concerned; but his strictures upon certain cities and communities are couched in terms which would scarcely warrant us in publishing them in the original. He expresses the hope that the article will now become an annual feature of the Contract Record, and we certainly have every belief that his desire will be gratified. The response to our request for particulars was a surprising one, and at the risk of repetition we must place upon record our appreciation of the courtesy extended to us by city engineers and city clerks. Without it, the article could never have appeared.

Sewage Disposal

"Sewage disposal," says our candid friend, "seems to be a misnomer as far as Canada is concerned, since, with the exception of quite a few cities, the sewage runs untreated into the nearest river or harbor. Whether this happens above or below the intake for water supply is a serious question which seems to have escaped the observation of your correspondents. Anyway, they are but few that have taken the trouble to give information upon it. Extensions to the sewerage system seem plentifully contemplated, but disposal works are woefully lacking. Surely, the one should imply the other. What a happy phrase, too, is that of 'sewage disposal by dilution'! It embraces quite a multitude of shortcomings. Taking the sewers themselves, now, has not the time come when wooden pipes should be dispensed with? There is clay and enough in the country, and properly vitrified and glazed pipes last for ever. On the score of economy alone, the sanitary article should be used. All cities are not of the whirlwind type." Really, were it not for our correspondent's very distinctive address, we should be disposed to acquit him of any knowledge at all of Canadian conditions. Towns grow and grow rapidly, but there is all the difference in the world between running up a hundred or two houses and installing a system of sewerage and sewage disposal. Festina lente must be the guiding motto of new centres of population. Hastily hatched schemes result only too often in failure and a waste of public money. Townships "travel," and the earliest buildings may form merely a suburb when the city stage has been arrived at. Until the broad lines of the embryo city are laid out, it is unwise to let expensive schemes go much further than the discussion stage.

Sewerage Systems

One important matter in connection with sewage disposal has strangely enough entirely escaped the notice of our correspondent, and that is the prevalence in the Dominion of the combined system of drainage. A complete separate system is not to be looked for, even in the largest cities, but some approach to it is necessary if sewage purification works are to be installed. The wide variations in the flow of sewage with a combined system preclude effective treatment, unless works of an unnecessarily lavish nature are laid down. When pumping must be resorted to, the situation is aggravated. It is usual now, in works laid out upon scientific lines, to provide purification plant and pumping apparatus for six times the dry weather flow, allowing any surplus to run past the works. Such a standard is, we consider, unnecessarily high for universal application in the case of Canadian townships. Where works may be laid down in quite isolated situations, only bare requirements need be considered, so long as the works are constructed with a view to future extensions. The separate is the only "bare requirement" system; and while its adoption is simple (if a little more expensive) in the case of new towns, conversions to it from a combined system will be a costly and a difficult matter. It seems to us then regrettable that for lack of a little forethought scores of growing towns are being saddled with a system that must enormously increase the cost of the sewage works ultimately to be provided, and that will in many cases retard their provision, simply owing to the extensive plant that will have to be laid down.

Refuse Dumping

Considerations of space compel us now to return to our correspondent's letter from which we have somewhat side-tracked. "Disposal by incineration!" he apostrophizes. "What a euphemism for a bonfire! It makes one gasp too to read of the large number of cases of garbage dumping, of the few cases of contemplated destructors, and of the isolated ones of a real live working incinerator. Over and over again comes the stereotyped phrase 'the garbage is deposited on dumps,' or 'the garbage is burned at a dump,' both systems being execrable in the highest degree. A 'nuisance ground' is a most appropriate term and speaks volumes. Pure and simple dumping means trouble and disease for succeeding generations, and a burning dump is but little better. Thorough incineration is never attained, and it does not, like a destructor, reduce the whole of the town refuse to a clinker. Refuse collection should imply the provision of a proper and sufficient garbage incinerator, even in the case of the smallest township." Here again a lack of knowledge of Canadian conditions seemed at first sight to reveal itself, but, continues our correspondent: "Precisely the same rule should apply to every civilized community. Obviously, there is no need for refuse collection in country places and among scattered communities established in what they are pleased to style towns. Householders in such places can, with but little trouble, dispose of their own refuse, either by burning or burying; but if the swelled heads of the ratepayers decide on the necessity for a collection then they should be compelled to dump without nuisance to present or future generations, and that can only be done by dumping straight from the carts on to a destructor feed plate."

Highway Works

Roads next receive the attention of our correspondent, and the painstaking way in which he has gone through the Constructional Centres articles is shown in the fact that he details twenty-nine materials for road construction that he came across in the various reports. The amount of money that is allocated for early expenditure on road work is satisfactory to him, and we gladly note that he "appreciates the difficulties which highway engineers have to contend with in Canada." In any future reports of the kind, he says, "it would be as well more intelligently to classify roads. An earth road is not a road, and it is doubtful whether a plank road is more than a plankway, similar somewhat to a scaffold run. Of one town with a population of 6,000, it is said 'all the roads are earth.' I would venture to substitute the statement with 'there are no roads in the town.' A road implies construction of some kind, and the fact that two rows of buildings are erected at a distance of 20 or 30 feet from each other does not necessarily mean that the intervening space is a road, any more than a plot of scrubby land fenced off at the back or side of a house is a garden. 'Macadam roadway,' too, is a term open to misconception, and capable of application to any road having a layer of stones spread upon it." On the whole our correspondent is satisfied that real interest is being taken in the provision of good roads, and he is content to leave it at that.

On the subject of water supply and lighting he has much to say, but none of it is of sufficient importance to warrant the allotment of space to it. On the former he would like a lot more definite information, pointing out that a statement such as "the water is supplied by a well" or "the water is pumped from the river" may mean that the community are drinking diluted sewage. We would point out, however, that it may just as well mean precisely the reverse, and we are not disposed to give prominence to any of the individual allegations he makes until we have before us the evidence of the other side. Generally, there is a goodly substratum of common sense in what he says, and his illustrations are apt and forcible; but his pen is too prone to outrun his discretion. As we have said, too, he does not appear to have got the hang of Canadian life and conditions. The rapid increase in population which is so marked a feature in so many cities—Saskatoon, for example, and Calgary—seems to have escaped his observation. Large public utility services cannot be installed in a month or two, and even if they could the question of dollars has no slight bearing upon the matter. Still, we thank our correspondent for his criticism, which, although of the destructive rather than the constructive order, was welcome and has been duly appreciated.

Contract Reform

A number of interesting comments upon the article, "Important Aspects of Contract Reform" (Contract Record, June 24), have been received. In a number of cases our correspondents express almost entire agreement with the arguments adduced by this journal, but some observations of additional interest are made by a Hamilton contracting firm who write us as follows:

"Contract reform is a subject which has received well-merited attention in the Contract Record, but there is still plenty of scope, not only for arguments but for work. We conduct general contracting operations on quite an extended scale and we can say that as a rule we are not handicapped by any lack of co-operation on the part of the architect or the engineer. We have heard it said that 'graft' is an appreciable factor in the business, but it must be declining, for we never experience the necessity of grafting measures. In our opinion the deposits required are not excessive. We think that a fair-sized deposit tends to eliminate undesirable competition and bring together contractors of the same class, keeping out those lacking in experience or capital. As to the principle of the lowest bid, there is no doubt that contracting is affected adversely by it, but we do not see what remedial measures can be taken when tenders are called for in good faith. When awarding sub-contracts, we, ourselves, make it a practice to invite bids from only those concerns to whom we would give the business, and almost invariably we award the contract to the firm submitting the best proposal. On the other hand, it is not our experience that low bids and incompetency go hand in hand. We have seen many a good contractor submit too low a bid and have to fulfil the specification and pocket his loss in the event of there being no change of conditions in his favor during the progress of the work. If an ignorant, inexperienced contractor, or one lacking in financial strength, submits a figure that is altogether too low, he should be disqualified—in the interests of the undertaking. Any other policy means trouble for the owner, the engineer, the sub-contractors and the material man. Possibly a thorough re-organization of the contracting interests might help the work of contract reform, but whence such reorganization?"

British Trade in Canada

Commenting upon the editorial article, "British Trade in Canada," published in our issue of June 17, an eastern contracting firm writes us:

"Your article brings out a number of interesting points, but we should like to add a word or two on the score of delivery. The great difficulty is that British firms have so much work on hand that their deliveries suffer, and consequently the importer of English goods is placed at a great disadvantage, delivery being one of the first things taken into consideration by Canadian firms. As a rule, old country firms are slow to appreciate the difference in conditions and they do not like the extended credit which is necessary for any firm doing business in Canada. British-made machinery and other supplies are second to none in quality and the prices compare favorably with those of their competitors on this side of the Atlantic. If the manufacturers of the British Isles will but take the trouble to study Canadian conditions and adapt themselves to Canadian requirements, the volume of trade will increase tremendously in the next few years."

A Novel Water-Filtration Plant for Toronto

(The Engineering News)

It is not often that a city takes up a novelty in water filtration or in any other class of engineering work on so large a scale as the proposed 72,000 U. S.-gal. "drifting-sand" filtration plant for which the city council of Toronto awarded the contract on June 8. It is true that two plants of a few hundred thousand gallons capacity are already in operation elsewhere and that contracts for two other and much larger plants are well under way. It is also true that a working unit was tested for 33 days at Toronto under the direction of the local medical officer of health and city analyst, and that this same test plant has been under observation for over a year. Nevertheless, the fact remains that the drifting-sand filter is as yet in the working-scale experimental stage, with few data yet available regarding its efficiency and less to be had regarding operating costs.

The drifting-sand filter may be described as a deep mechanical filter with reversion to the early type in the way of absence of coagulation basins and rate-controllers and with the addition of continuous washing and replacing of filter sand. It is claimed that this added feature makes up for the lack of a coagulating basin. To what extent this claim will be made good by experience at Toronto and on different waters at other places, it will be interesting to learn a few years hence.

Those who have followed the history of mechanical filtration will remember that the basic patent for the process was upheld very largely on the claim that the process obviated all need for precoagulation, but that as the years have gone by precoagulation has come to be regarded as more and more essential. In much the same way, new types of sewage filters, at first held to be all-sufficient, have been found by experience to yield a better effluent at less cost when pretreatment and in some cases after-treatment was employed. In other words, up to this time a vast body of experience has proved that as a rule some lightening of the burden on both water and sewage filters is desirable. The broadest exception to this rule is when water filters, and particularly slow sand filters, treat relatively clear and colorless water. In so far as the Toronto

The Steam Shovel

By Ralph Bacon

I am master of earth, and my glad heart sings,
As backward and forward my bucket swings.
I lift up the tons of rock and sand,
And I pour them into the cars that stand
Patient and still with their mouths held wide.
When I fill them up they go satisfied
Off to the dam, the levee or the road,
Or to build up a swamp for a city's abode.
I never am weary; my arm of steel
Labors for joy; I am glad to feel
The great earth trying to hold the clay
That my titan strength keeps tearing away.

Oh, I am king of the digging crew!
Can a hundred men do the work I do?
Can they work all day, and then all night,
Without sleeping a wink or eating a bite?
Can they work a month on a drink of oil
In the arctic blast or the tropic broil?
No men can do the things I do,
For I am king of the digging crew!

The railroads follow where I make way;
I join the rivers; I curb the bay;
I bring the waters from highlands down
To the barren valley and thirsting town;
I level the heights and gorge the fills;
I bring the power to the mighty mills;
When I come to a mountain, I cut it through,
For I am king of the digging crew!

Down on the Isthmus of Panama
I was the will, I was the law!
I am the monster the mountains dread;
When the sun beats down and men drop dead,
I sink my teeth in the hard red clay
And sing as I tear the earth away;
And I laugh as I let the oceans through,
For I am king of the digging crew!

When man conquers the land, he lays it waste;
When I conquer the land, canals are traced
Across its deserts that straightway fling
Over themselves the garments of spring.
If I boast, it is only of things I do,
Of the peace and plenty I bring to you,
For I am king of the digging crew!

water falls in this class precoagulation may be unnecessary, even for mechanical filters. As has already been stated, it is claimed for the drifting-sand filter that precoagulation is not required.

The foregoing illustrations do not prove and are not intended to prove that the drifting-sand filter is not going to be a great advance in filtration. They do raise questions as to its rendering precoagulation unnecessary, and to the experienced will suggest various other questions regarding these filters which must yet be settled.

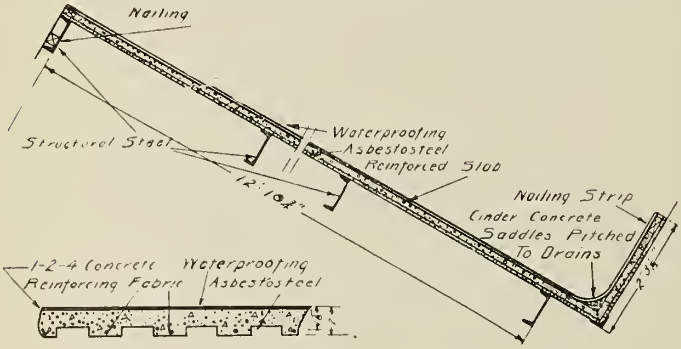
A city less venturesome than Toronto would probably have deferred awarding so large a contract for a new type of filter until it had been tested under the direction of consulting engineers. Such tests might well have included the standard type of mechanical filter, operated with and without precoagulation, and they might also have included slow sand filters, the whole dealing with the same raw water. As events have proven, no time need have been lost by the more comprehensive tests, since over a year has gone by since the tests on the drifting-sand filters were begun.

However, the city authorities of Toronto did not adopt the new filters until after a test under the direction of local officials and a long period of observation. They have the assurance that the engineering details of the proposed plant have been worked out with great care by the engineers.

Other cities will have reason to thank Toronto for having the courage of its convictions to the extent of constructing a large example of this new and interesting type of water filtration plant.

Field Notes on Saw-Tooth Concrete Roof Construction at Windsor, Ont.

An interesting example of light concrete roof construction has just been completed at the new building for the Remington Arms-Union Metallic Cartridge Company, Windsor, Ont., Canada. The general construction of the building is the saw-tooth type, the slope of the separate roofs being 30 deg. There are nine sections, six of which are about 150 ft. long, and three 50 ft. long. The skeleton work of the building is of steel with the roof trusses carried on plate girders spanning columns about 50 ft. o. c.



Structural details showing the arrangement of the asbestos steel, concrete slab, structural purlins and gutter details.

The roof in general was constructed of 24-ga. Asbesto-steel, covered by a smooth concrete slab about 1½-in. thick, in which was embedded a wire mesh of mild steel, the mesh being fastened to the bottom of each corrugation of the sheets by special clips, thus insuring the position of the wire at the bottom of the slab and giving a roof of maximum strength.

The steel sheets are of open-hearth steel covered on both sides with asphalt and white asbestos and present a very attractive appearance as an interior ceiling for the building. There was no necessity for plastering the under side. It is claimed that the asbestos covering and asphalt binder give a highly insulated roof. The corrugations of the sheets are about ¾-in. deep and about 2⅜-in. wide.

The erection of the sheets was simple and required but two men to handle the material on the roof and a laborer on the ground who raised the sheets to the men and who also placed the clips for attaching the reinforcing mesh on the sheets before they were raised. Special purlin clips were furnished for fastening the sheets to the roof purlins in such a manner that the fasteners were not visible from the under side. In the same manner the sidelaps of the sheets were fastened to form a continuous joint in the corrugations and did not destroy the uniform appearance of the under side of the roofing sheets.

The erection of the roofing sheets was completed just about the same time as the brick parapet walls were carried up to the roof line and the concrete work started immediately. A serious problem of preventing this very thin slab of concrete from freezing had to be taken care of at this time, as the temperature was very low.

Equipment and Plant Arrangement

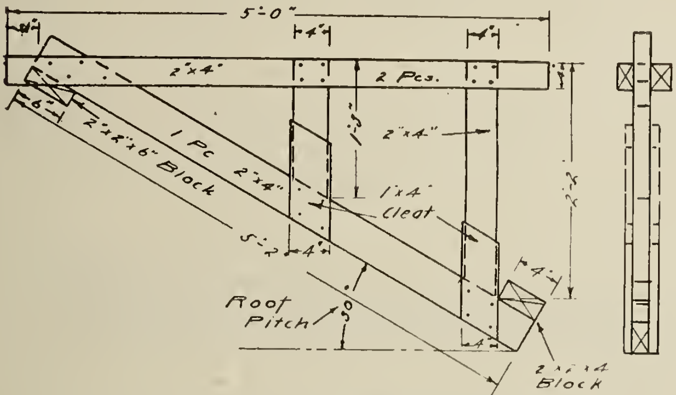
A 1-3-cu. yd. mixer connected to a steam engine with a 10 h.p. boiler, was used for mixing all the concrete. Hot water was obtained from this boiler to wash the snow and ice from the sheets. A steam line was also run from this boiler to heat the sand pile. Three 1-in. pipes were carried under the sand pile, the pipes being perforated to allow the steam to escape. The steam pressure was kept up all night, a night watchman taking care of the fire, and the steam was allowed to escape into the sand pile all the time.

The mixer and the tower were located at about the centre of the south wall. The tower was built of 2 x 4's spiked together to form 4-in. x 4-in. corner posts and 1-in. boards for braces. This tower was about 40 ft. high. The cage was made large enough to carry one wheelbarrow. A horse was used to raise the material. A counter-weight which was hung on the rope which passed over the sheaves on the top head frame and the bottom foot block assisted materially in decreasing the load the horse had to lift. A curious fact was that the horse had no difficulty in raising the load but seemed frightened when the cage was lowered, and the load of this cage pulled him back. A hook made of ¼-in. band iron hung from the head frame and was swung under the cage as it reached the top, thus taking the load away from the horse and insuring against danger while the full wheelbarrows were unloaded and the empty ones sent down.

A central runway about 5 ft. wide was constructed, crossing at right angles the stretches of saw-tooth gables, and the concrete was delivered to each section of the roof from this runway. Small triangular horses (which are shown in the sketches) were made on the ground, and these were used to support the plank runways. They were easily put in position and were shifted from one section of the roof as it was concreted to the next one with very little labor and loss of time. In fact, the concreting proceeded continuously without any necessity for stopping to shift the scaffold. The horses were made so that they hooked over the top purlin and the bottom end rested on the purlin below, thus taking all the load off the sheets and slabs.

Placing the Concrete Roof Slab

In placing the concrete, screeds were nailed to the sheets about 8 ft. o. c., and these screeds were left in the concrete slab to serve as nailing strips for the waterproofing. Dry concrete was first placed in the gutters the entire length of the section and then the slab was poured and the gutter finished at the same time. On account of the steep pitch the consistency of the concrete was very dry. The surface was floated to a smooth finish.



Detail showing the construction of the triangular runway horses.

As an added precaution against freezing the concrete was also protected after it was poured. Large salamanders were placed in the room below and tarpaulins were hung from the roof trusses to confine the heat at the portion of the roof at which the concrete was being poured. The ends of the saw-tooth sections were boarded up and all over the roof 1-in. boards were placed, on top of which were laid bags filled with manure. In this way the roof was protected against cold from all possible directions. The handling of the manure in this way proved very expeditious and also eliminated dirt and loss of material which would have resulted if the manure had been placed loose on the roof.

The ventilators shown on the building were bolted to the sheets before the concrete was poured and the metal of the asbestos sheets cut out for the round openings at the same time the sheets were erected.

The work was interrupted several days on account of snow. However, by employing a large gang of laborers and cement finishers, the concrete was all poured within 8 days after starting.

A standard built-up waterproofing was installed and the flashings at the parapet walls and at the ridges were the standard asbestos protected material used for flashing purposes.

All of the erection of sheets and placing of the concrete was performed by the Asbestos Protected Metal Company, Beaver Falls, Pa., under the supervision of Meyer Davis, this firm's engineer representative. —Concrete-Cement Age.

The Quantity System

Some of the advantages of the quantity system of estimating, as enumerated by G. Alexander Wright, of San Francisco, are as follows:

1. Saving of time and money.
2. Greater precision in measuring.
3. No uncertainty as to interpretation of plans or specifications (the quantities should govern).
4. No visits to the architect's office when figuring, for explanations or otherwise.
5. No other work is contracted for except the quantity set forth in the quantities.
6. The contractor, if he so desires, can check up the quantities before signing a contract.
7. No bidder can inadvertently leave out anything, and so in this way arrive at too low a figure.
8. No having to spend time taking out his quantities, the contractor has time to attend to more profitable business.
9. Systematically arranged bills of quantities duly priced (whether work has been secured or not) form excellent data for making future estimates.

A remarkable example of reinforced concrete applied to architecture is to be seen in a building now nearing completion in Paris. The structure is a block of flats of six storeys in the Avenue Bugeaud, where the Metropolitan Railway of Paris passes under the roadway, and the ocupants of houses facing the street suffer considerable inconvenience from the vibration of passing trains. In order to avoid trouble of the kind in the new building, the architect decided to isolate it entirely by supporting the entire structure on a series of seventeen ferro-concrete stilts, or columns, carried down to a stratum of solid rock, at a depth of about 60 ft. below the surface. Each column is contained in a shaft, and rises from bedrock to street level without touching the sides, and the columns support a framework of girders on which the building is constructed. A small space is left on either side between it and the houses on each side of it, and the facade is separated from the roadway by a sort of mattress of steel springs. Thus, the building stands practically clear of everything around it, the foundations touching nothing but the bedrock from which they rise. It is stated that this novel method of construction has proved entirely successful as regards the prevention of vibration.

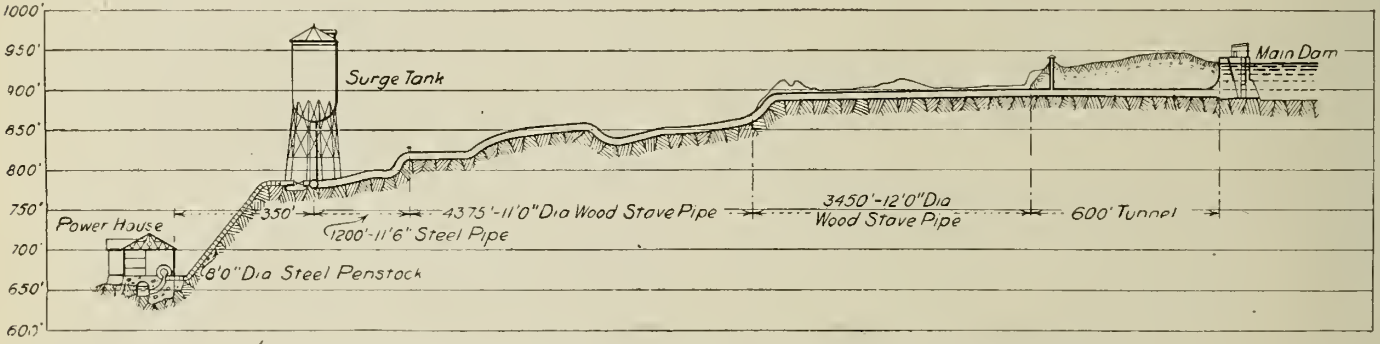
An ingenious analytical method for estimating substances susceptible of precipitation from liquids has been invented by M. Dienert, chief engineer of the City of Paris water supply, by combining the calorimetric process of Dubosc with the projection lantern. By comparing in the two halves of the field a liquid containing matter in suspension and a standard liquid, it is easy to see if the colouration is the same. The method is applied to the estimation of matters contained in natural waters, and only requires 20 to 30 cubic centimetres of water for each analysis. It is stated to be as exact as the usual methods.

A well-designed reinforced concrete structure, as pointed out by Ferro-Concrete, is actually jointless. Therefore, a load concentrated on one portion of a building is distributed over a large area of the surrounding structural members and any local tendency of a building to settle is resisted, not by the parts locally affected, but by the structure as a whole.

Constructional Features of the Salmon River Hydro-Electric Development

A Central New York Plant Operating in Parallel With the Ontario Power Company's Niagara Falls Plant

The new hydro-electric plant of the Salmon River Power Company, which comprises a development of 30,000 h.p., operating under a head of 245 feet, has many points of constructional interest. The Salmon River flows from the foothills of the Adirondacks in a westerly direction through the northern part of New York State into the eastern end of Lake Ontario. While the length of the stream is only 44 miles, it drains a watershed remarkable from the hydraulic standpoint in that over a tributary area of 190 square miles there is an average annual rainfall of about 60 in. In addition, the river falls 650 ft. in the 17 miles between Stillwater and the lake and more than 400 feet in a distance of less than eight miles. At Salmon Falls the drop is 110 feet. While the flow of the stream is somewhat irregular, the valley above the Salmon Falls is of a form suitable for storage purposes. Moreover, the location of the site is such as to enable the power company to dispose of the entire output of the plant to the Niagara, Lockport & Ontario Power Company, which has leased the property in perpetuity and acquired all its capital stock. The latter company draws its supply at present from the plant of the Ontario Power Company at Niagara Falls and from its own steam plant at Lyons and Auburn. It can utilize the full output of the new plant to advantage in combination with the other three.



Elevation of the Salmon River hydro-electric development, showing the relation of its various structures.

From the hydraulic standpoint the features of interest are the concrete dam and spillway situated near Stillwater, the artificial lake about eight miles in length and 5½ square miles in area, impounded by it, the 2-mile conduit of wood-stave and steel pipe, the distributer in which the conduit terminates, the enormous and novel surge tank, the Johnson valves in the penstocks, the penstocks themselves, the turbines and their governors, and finally the tailrace. With the aid of the illustrations a comprehensive view of these parts of the installation can be readily obtained and only the salient features need special description.

The Salmon River is of the kind found all through the lake district of central New York. The riverbed is at the bottom of a narrow valley with rather steep hills rising on both sides. At places the valley widens considerably, as, for example, just above Salmon Falls; at others it narrows into a gorge with steep banks, as at Stillwater. By the location of a dam at the latter point with a crest at an elevation of 935 a large area was submerged with little loss of property, as the valley is sparsely settled. Only a dozen or so of dwellings, including several on the edge of the village of Redfield, and a few miles of highway had to be relocated. The height of the dam crest is limited to about 935 unless more extensive dikes are built to prevent diversion of the water into the watershed of the streams draining into Oneida Lake, several of which take their rise on the south side of a narrow ridge which parallels the Salmon River closely on the south.

The artificial lake has a capacity of 2,600,000,000 cu. ft. with the dam crest at 935, and, at the average rate of flow of the stream, about twenty days are required to fill it. With the crest at this height the average net head produced at the power house less than 2 miles away is 245 ft.

The present temporary crest is at elevation 924, but during the present year it will be raised to elevation 935. Keyways are provided in the temporary spillway to tie the future concrete cap to the present structure, the crest being temporarily formed with a wooden apron. On the down-stream face of the dam is a 25-h.p. Pelton wheel for the gate drive, connected by long shafting and bevel gearing to a longitudinal shaft in the gatehouse. By means of clutches the gate-raising mechanism is connected to this shaft.

The conduit connecting the dam and the power house consists of five sections, a 600-ft. reinforced concrete-lined tunnel drilled through rock, a 7,825-ft. length of wood-stave pipe, a 1,200-ft. length of steel pipe, a steel distributer and four short penstocks. The topography of the country between the dam and the power hopse, which is situated at Bennett Bridge, is such that an open canal could have been used. The pipe line, however, was found to be cheaper.

The tunnel was necessary at the dam end of the line to pierce the southerly ridge previously referred to. It is lined with concrete not less than a foot in thickness with circumferential reinforcing rods closely spaced, and it has an inside diameter of 12 ft. The wood-stave pipe continues at the same diameter for

3,450 ft., the diameter being reduced to 11 ft. for 4,375 ft. more. The staves are of kiln-dried Douglas fir cut not less than 3⅝ in. thick for the 12-ft. pipe and 4 in. for the other. They are joined end to end by means of galvanized-iron keys and are held circumferentially with bands of ⅞-in. and 1-in. steel rods. Each band is in three sections, all united by cast-iron clamps. In soft ground the pipe was supported on timber cradles, but otherwise it was laid directly in the surface. It was coated on the outside with Avenarius Carbolineum and afterward back-filled to about one-half its height. Relief valves were inserted at intervals to prevent undue pressure when emptying the pipe, and to serve as air outlets when filling, and drains were placed at all low points. The engineers selected wood pipe for that part of the conduit in which the pressure was not too great because, in the cold climate of the region, it is cheaper than steel pipe when the latter is properly protected from freezing. Fir was used because it is an excellent wood for pipe not subjected to alternate wetting and drying in that it remains tight, does not rot and is reasonable in price.

The steel-pipe section is 1,200 ft. in length and 11½ feet in diameter. It is connected to the wood pipe through a slip expansion joint packed with oakum and lead wool. Special attention was given to the material in this pipe, which was specified as open-hearth steel containing not over 0.05 per cent. sulphur and between 0.3 and 0.6 per cent. manganese. The phosphorus was limited to 0.06 per cent. if the steel was made by the acid process and 0.04 per cent. if by the basic process. The thickness of the pipe is ⅝ in. throughout. The steel pipe was mounted on concrete saddles 20 in. thick and spaced about 14 ft. apart. It was laid in a shallow well-drained trench and a 6-in. sewer tile was molded in the bottom of each saddle to facilitate drainage. The pipe was housed over with a substantial structure of framing and boarding continued down to the ground level. The roof, of 1-in. boards, was covered with a layer of roofing paper. Trap doors were placed in the roof over all manholes.

From Distributer to Tailrace

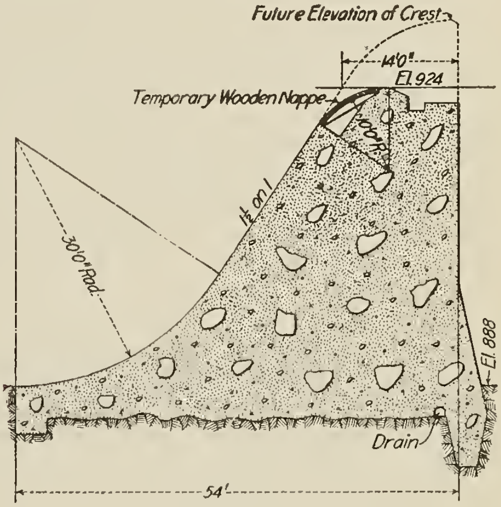
The more novel features of this plant are found in and near the power house. On the crest of the ridge just behind are not only the most conspicuous but also the most original elements of the hydraulic equipment. First there is the distributer, a 12-ft. steel pipe 210 ft. in length and joined at one end to the pipe line in a huge concrete anchor block. The other end is closed by a bulkhead. The elevation of the bottom of the distributer is 775 feet, or 160 feet below the crest of the dam.

From the center of the distributer a 12-ft. riser branches off to a surge tank. This enormous T-connection requires reinforcing from side to side, and this is provided by a 9-in. bolt, 25 ft. long, with bearing washers for the nuts 4 ft. in diameter. The surge-tank riser joins the distributer with easy curves, but a novel and cheaper connection is made to the penstock intakes, 8 ft. in diameter. This is a simple flanged and riveted joint, which would, without some modification, produce eddies and loss of head. To prevent such, wooden fillers suitably rounded off are secured around the mouths of the intakes inside the distributer.

The distributer is a steel pipe, ⅝ in. thick, inclosed in concrete.

The surge tank, built by the Kennicott Company of Chicago Heights, Ill., is the largest of its type yet constructed. It consists of a cylindrical shell, 50 ft. in diameter and 80 ft. high, surmounting a hemispherical bottom which adds 25 ft. to the height. Its capacity is, therefore, 1,400,000 gal. The tank is supported on ten columns with heavy concrete footings. It and the riser are housed in with a framed wooden structure providing a surrounding air space which can be heated when necessary from a small house below. The top of the roof of this structure is 205 ft. above the ground, and the top of the tank is high enough above the crest of the dam so that if the flow of the water in the pipe line were suddenly interrupted its energy would be absorbed by the rise in level in the tank without overflow.

An important feature of the surge-tank riser remains to be mentioned. With a 12-ft. riser opening into the bottom of the tank there would not be friction enough to absorb the energy of a surge, which would therefore tend to set up oscillations. To provide for the damping of such oscillations, a smaller pipe is mounted inside the tank, connected directly to the riser below and terminating in a funnel near the top. The rest of the mouth of the riser at the bottom of the tank is covered by a ring in which small ports are provided. In action, therefore, a surge produces a rise in the small pipe and some flow through the ports. The head in the small pipe then forces the surplus water through the ports and equalizes the pressure gradually. This process is technically termed "differential action" and is an invention of the hydraulic engineer of the Ontario Power Company, Mr. R. D. Johnson.



Cross-sectional elevation of dam.

The four 8-ft. penstocks are connected to the intakes through valves of a type which represent a comparatively new development in hydraulic practice. They operate under a head of nearly 154 ft. The type of valve used is also the invention of Mr. Johnson, manufactured by the Wellman-Seaver-Morgan Company.

Below the valve houses are the four 8-ft. penstocks, anchored above and below in heavy concrete blocks, and laid in trenches and entirely back-filled. The steel plates vary in thickness from ½in. on the upper horizontal portion of the penstocks to ⅞ in. at the lower end where they enter the power house.

The 10,000-h.p. Turbines

The four turbines are of the Francis horizontal, single-spiral, double-discharge type of 10,000-h.p. rating each. They are provided with outside, balanced wicket gates operated by Lombard governors. These machines have guaranteed efficiencies of 82 per cent. at full load, 85 at three-quarters load, 80 at half load and 70 at quarter load. The specifications on governing permit not more than 15 per cent. increase in speed above the normal value of 375 r.p.m. on the sudden removal of full load, 6 per cent. for half load, 3 per cent. for quarter load, and 1.5 per cent. for tenth load. The turbines are provided with heavy flywheels to assist in governing and to facilitate the operation of the electrical equipment of the plant in parallel with the Niagara, Lockport & Ontario Power Company's system. The turbines are provided with relief valves operated by the governors, so that the sudden checking of over-speed cannot result in an excessive rise of pressure.

The discharge of the turbines is conducted to the tailrace through short concrete draft tubes, entering at an obtuse angle to prevent eddies. In fact, on its entire journey from reservoir to tailrace the water is led with as few turns as possible and around easy curves. The tailrace is directly under the power house, which is built over the bed of a branch of the river that previously carried water at times of flood and was with little expense transformed into a tailrace. The exit of the tailrace from the building is closed by a curtain wall which prevents the ingress of cold air. The old riverbed, below the building, was cleared out for a distance of several hundred feet, and the banks were reinforced with dry-laid stone walls.

The Power House

The power house is a simple structure consisting of reinforced-concrete pilasters connected with heavy concrete beams. The panels are filled with red brick outside and sand-lime brick inside. The roof, supported on steel trusses, is 3 in. thick, of gypsum composition reinforced with steel cables and rods. This is the Metropolitan Fireproofing Company's system and was installed by the Keystone Fireproofing Company. The roof is covered with an asphalt coating overlaid with several layers of asbestos felt. One purpose in the use of this particular type of roof was to secure a fireproof base to which tile could be nailed in case it was later found desirable to add a tile roof. The gypsum roof is very light and was easy to place.

The building is rectangular with a projecting feeder bay. The interior is open to the roof and, with the exception of a gallery about 12 ft. above the main floor on the feeder-bay side, forms one great room. It is served by a 40-ton Shaw electric crane with main and auxiliary hoist all driven by 250-volt direct-current motors. The crane has a 38-ft. span and the runway covers the entire length of the building.

Coming now to the foundation of the building, the construction already briefly referred to is especially interesting in that the intake pipes, the draft tubes and the discharge tunnel are all directly under the building, embedded in or formed of concrete which rests on solid rock.

Each of the four electrical generating units consists of a 375-r.p.m.,6600-volt, twenty-five-cycle, three-phase generator with exciter mounted on an extension of the shaft; three 2200-kv.a., single-phase, twenty-five-cycle transformers with a normal ratio of 6600 volts to 34,650 volts, with high tension in star, giving 60,000 volts line voltage; a 6600-volt, 1200-amp., triple-pole, single-throw, type "C" oil circuit-breaker, automatic for reverse power, and the necessary connecting cables and auxiliaries. Each unit is thus as nearly self-contained as possible, with all parts placed conveniently near together.

The engineering of the plant has been under the direction of V. G. Converse, chief engineer of the Salmon River Power Company. During the preliminary work and the designing period D. R. Cooper was assistant chief engineer. Most of the hydraulic features were designed by R. D. Johnson, hydraulic engineer, of the Ontario Power Company, and the electrical features by J. A. Johnson, electrical engineer, of the Ontario Power Company. Barclay, Parsons & Klapp had charge of the engineering and construction of the dam and acted as consulting engineers for the entire work. Francis V. Greene is the president of the Niagara, Lockport & Ontario Power Company. The plant was put into operation April 10, 1914. Two units are now in operation and the third and fourth are in process of installation.

City Engineers' Office Methods

THE following data from the recently issued annual report of the Commissioner of Public Works of St. Paul, Minn., give the office methods of a large city engineering office quite succinctly.

Indexing—Card indexes are kept: (a) Of recorded plats; (b) of park plats; (c) of established grades on streets and alleys; (d) of contracts, indexed by street and name of contractor; (e) current index of preliminary and final orders from the Board of Public Works and the letting of contracts thereon; (f) index to all survey notes; (g) graphic index to monuments as established; (h) general index, openings, slopes, sewers, etc., including special and general structures; this is one of the largest and most comprehensive of the indexes, made necessary by the wearing out of the present book system, and is about 90 per cent complete. Full advantage has been taken of numerous opportunities for cross indexing, including the same plat under various heads, such as location, character of work, departments, etc.

Book-keeping—A card-index system of book-keeping was so planned as to serve as a journal and ledger record.

Filing—A card index of field books taken from vault is kept. The clerk in charge of records charges all books against the employee using them, and is able to locate the party having them, giving them credit when records are returned.

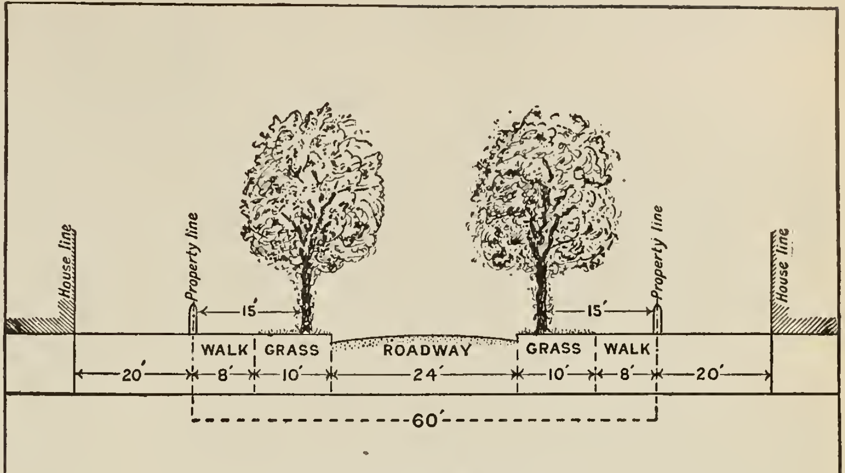
The London, Brighton & South Coast Motor Roads Syndicate Company, Limited, is having a bill introduced in the Imperial Parliament to secure sanction for the construction of a highway exclusively confined to automobile traffic. The road-bed proposed is to be of reinforced concrete with a bituminous surface. It will be about 50 miles long and 150 feet wide and will involve an estimated outlay of $25,000,000. The entrance to the highway will be at Richmond and the southern terminal Brighton. Three tracks will be provided, the first being for fast traffic, the second for heavier vehicles, and the third for auto cycles and cycle cars. The plans provide for the erection of an ornamental stone arch and a rectangular building for garages, workshops, etc., near the entrance to the road at Richmond.

Evolution of a Business Street

THE solution of the problem of the congestion that is found in the main streets of towns is to plan residential roadways so that they may be transformed gradually into business streets at a minimum of expense. One way in which this may be done may be understood by a glance at the accompanying illustrations.

The upper diagram shows a street 60 feet wide and suitable for a residential section. The roadway is of moderate width, sufficient to accommodate the light traffic of delivery wagons, carriages, etc., that serve the houses on either side. A boulevard and trees give it a pleasant appearance, and, also, the houses are set back 20 feet from the property line, with gardens or lawns between them and the sidewalk.

COMMISSION OF CONSERVATION



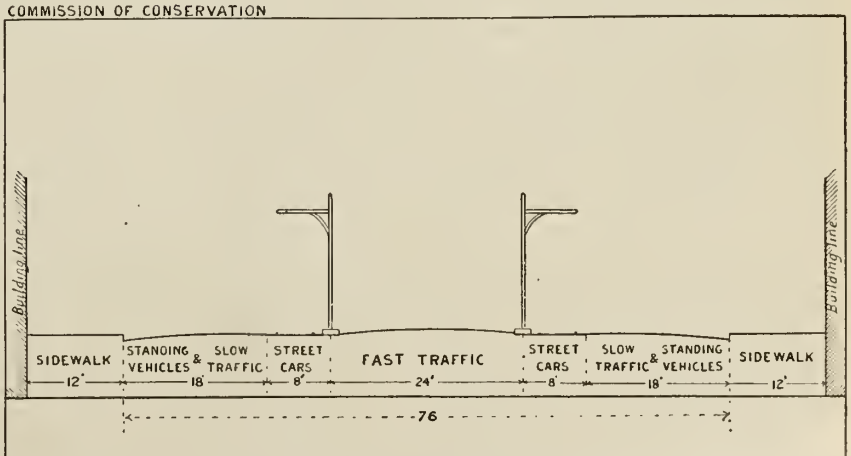
A 60-FOOT STREET

If commercial interests should invade this region, property owners would, under ordinary circumstances, build forward to the sidewalk, partly to use the extra space, but chiefly to bring store windows flush up to the causeway. A portion of the street in process of transformation presents a very ragged appearance, due to the lack of a uniform building line. When the process is complete, the once beautiful residential street has become a congested business thoroughfare with narrow walks and a 44-foot roadway. To widen it would necessitate the tearing down of valuable buildings and would be a heavy expense to the taxpayers.

Foresight would obviate this undesirable development. All that is necessary is to establish a restriction prohibiting the use of land for building beyond an established line. Legally, of course, this involves compensating the property owners, but the damages can be distributed over a long period in a simple way. No property rights need be acquired by the municipality until application is made for a building permit on an obstructive site, and then the restriction can be imposed and paid for. In this way the public thoroughfare is gradually widened at exactly the same rate as the growing commercial interests require. At no time is it necessary to pull down buildings. When any considerable number of property owners require it, the walk may be moved over to the building line and the roadway widened. The trees should be left as long as possible, and, unless a street railway is constructed, should be a permanent feature.

The lower diagram shows the ultimate development of the 60-foot street into a 100-foot thoroughfare. Safety for pedestrians crossing the wide roadway is provided by "islands" at the base of each pole holding the electric wires. Motor-cars may run up and down the middle unimpeded by slow-moving wagons and drays, while the latter have ample room to pass between the street car tracks and standing vehicles by the sidewalk.

COMMISSION OF CONSERVATION



A 100-FOOT THOROUGHFARE

In connection with the above it is interesting to compare the following extract from a recent address by Mr. Raymond Unwin, F.R.I.B.A., before the Victoria League Imperial Health Conference in London: "There are certain requirements of town planning which are fairly obvious and generally applicable, such as the prevention of the overcrowding of dwellings, and the fixing of such a building line on all the main highways radiating out of the town into the country, as will prevent buildings being erected so near to these roads that future widening can only take place at excessive cost after demolition of the buildings."

A bridge which will probably be the third largest in the world as regards length of span, and the first as regards headway for shipping, will be constructed across the harbor of North Sydney, Australia, in conjunction with an underground railway system. The specifications provide for nickel-steel cantilevers supporting centre girders also of nickel-steel. The shore arm of the cantilevers will be about 500 feet long and the cantilever arms 520 feet long, while the length of the centre girder will be about 560 feet. The approaches to the bridge will consist of steel arch spans of the three hinged spandrel braced type.

Explosive Gases in Sewers and Precautionary Methods

By G. J. White[*]

EXPLOSIONS of gases in sewers, while not of very frequent occurrence, constitute a serious danger to both life and property in cities. A discussion of the various gases which may ordinarily collect in sewerage systems will serve as an introduction to this paper.

GASES FOUND IN SEWERS

Air.—Air consists of approximately 20.96 parts of oxygen, 79.0 nitrogen, 0.04 of carbon dioxide, and other impurities, by volume. It is colorless and odorless. It has a specific gravity of 1, and forms a basis to which the specific gravities of other gases are referred. It is not explosive in itself, but furnishes the oxygen necessary for the explosion of other gases, which by themselves may be non-explosive.

Sewer Gas.—Sewer gas consists of approximately 90 parts of nitrogen, 2 to 4 parts of oxygen, 1 to 3 parts carbon dioxide 3 to 5 parts of carbon monoxide, methane and other gases, by volume. The specific gravity varies with its composition and is approximately 1, or the same as air. It has an odor due to the organic decomposition constantly going on in the sewage with which it is in contact. It is not poisonous in the true sense of the word, but due to its high percentage of nitrogen and low percentage of oxygen, it will not furnish a sufficient amount of oxygen to support respiration, and hence a person is slowly smothered in an atmosphere of this gas. It is non-explosive in itself and, due to its high nitrogen and low oxygen content, would undoubtedly prevent the explosion of otherwise explosive gas when mixed with it, unless some other gas such as air were added to furnish the necessary ogygen for the combustion.

Coal Gas.—Coal gas is made by the destructive distillation of high-volatile coal in clay products. Its composition varies with the kind of coal used and the details of manufacture. It consists of approximately 3 parts of illuminants (ethylene, etc., of the C_nH_{2n} group), 35 to 40 parts of marsh gas, 45 to 50 parts oxygen, 1 to 2 parts carbon dioxide and 3 to 5 parts nitrogen, by volume. It is colorless, but has a very strong penetrating odor, so that a smell percentage of coal gas mixed with air may be readily detected by the sense of smell. In itself, it is not explosive, and must be mixed with air or some other gas which will furnish the necessary oxygen for combustion. A cubic foot of ordinary coal gas requires 1.21 cu. ft. of oxygen, more or less, due to the variations in the constituents of the gas, for complete combustion. If we allow 20 per cent. of oxygen in the air, then for complete combustion $1.21 \times 5 = 6.05$ cu. ft. of air is necessary to furnish the oxygen for the combustion of 1 cu. ft. of gas. An explosion will take place with mixtures of from 4 to 12 parts of air with one part of coal gas, the intensity of the explosion varying with the mixture. The specific gravity of coal gas varies with its composition from 0.50 to 0.60, or it is about one-half times as heavy as air.

Water Gas.—Water gas is made by passing steam through a bed of incandescent carbon. Water gas thus made would have a comparatively low heating value and relatively small candle power. Therefore, it is enriched by spraying volatile oils on pure water gas while passing through towers filled with checker-work brick, which are heated to incandescence. The composition of water gas varies with the details of manufacture. Water gas is composed of approximately 25% carbon monoxide, 10% illuminants, 30% of hydrogen, 1% oxygen, 3% carbon dioxide, 25% methane and 6% nitrogen by volume. It is non-explosive in itself and must be mixed with air or some other gas which will furnish the oxygen necessary for combustion. It has approximately the same explosion range as coal gas. It is extremely poisonous, due to its high carbon-monoxide content. It has a penetrating odor, even more noticeable than that of coal gas. The specific gravity of water gas varies from 0.45 to 0.55 with its composition.

Coke-Oven or Solvay Gas.—Coke-oven or Solvay gas, like coal gas, is made by the destructive distillation of coal in ovens. In coal-gas manufacture, the gas is the main product, while coke is a secondary or residual product. In coke-oven gas manufacture, the coke is the main product and the gas is a secondary or residual product. The composition of Solvay gas is similar to that of coal gas. Like coal gas, it is colorless and has a penetrating odor. Like coal gas, it is non-explosive in itself, but becomes explosive when mixed with various quantities of air. The range and the intensity of the explosion are approximately the same as those of coal gas.

Illuminating Gas or City Gas.—Illuminating gas or city gas as generally distributed, may be coal gas, water gas, Solvay gas, or a mixture of any two or all of these gases. It is colorless and has a strong penetrating odor. Gas fitters can detect a leak in a gas fixture, by the sense of smell, that will not light. It has ordinarily a specific gravity of 0.50 to 0.60 or about one-half that of air. It is non-explosive in itself, and will explode only when mixed with 4 to 12 volumes of air. City gas stored in a gas holder would not explode if the holder were struck with lightning. If the tank was ruptured sufficiently to let any large amount of gas escape, there would simply be a flash similar to that following the throwing of a lighted match into an open barrel of gunpowder. I have seen workmen mark leaks on a gas holder by igniting the gas issuing from the holes.

Gasoline.—Gasoline of the American trade varies somewhat in its specific gravity from 0.70 to 0.74 as measured by the Beaume scale. 0.70 is a light grade, and 0.74 is termed stove gasoline from its general use for heating. The analysis of the 0.71 gravity gives carbon 838; hydrogen, 155; inpurities, 7 in 1,000 parts, with a heating value of about 18,000 B.t.u. per lb. The variation of the gravity of gasoline is due to the variation in the percentage of hydrogen. The vapor of gasoline is equal to 160 cu. ft. per gal., or about 1,200 times its liquid bulk. A saturated air gas of equal parts air and vapor equals 320 cu. ft. per gal. of liquid. It is non-explosive in itself, and when mixed with air is used as an explosive power in gasoline and automobile engines. The boiling point of gasoline such as is used for explosive engines, ranges from 150 to 180 deg. F., and the flashing point of the liquid ranges from 10 deg. F., with complete combustion of the vapor. The vapor of gasoline from 1 lb. of the liquid requires 189 cu. ft. of air and as 1 lb. is equal to 26 cu. ft. of vapor, $^{189}/_{26} = 7.3$, so that one part of gasoline vapor with 7.3 parts air may be used to produce a perfect combustion. Fewer parts of air will leave a residum of unconsumed vapor, while an excess of air will lessen the intensity of the explosion, and if the excess is sufficient will prevent the explosion. Gasoline vapor has, when mixed with air, an explosion range from 2 parts air to 1 part of gasoline vapor up to 19 parts air to 1 part gasoline vapor, the intensity of the explosion varying with the mixture. The specific gravity of gasoline vapor is from 1½ to 2½ times that of air. It is colorless and has a penetrating odor.

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[*] Gas Inspector and Analyst, Department of Public Works, Detroit, Mich., writing in the Engineering News.

SOURCES OF GAS VAPORS IN SEWERS

Our cities are covered with a network of pipes used in the distribution of illuminating gas. Breaks in these gas mains very often lead to the escape of this gas into the sewer systems. Due to the comparative depth of trunk sewers and gas mains, it is not likely that any great amount of illuminating gas gets into the trunk sewers themselves. We may expect and do find it in lateral sewers, telephone and electric-light conduits, where comparatively small amounts would be necessary to furnish an explosive mixture. Where telephone and electric-light conduits have untrapped connections to the main sewers, there will be a tendency for any illuminating gas present in the main sewer to escape into these conduits. Since it is only one-half times as heavy as air, it is more likely that any illuminating gas getting into a main sewer would tend to work its way out through the lateral sewers which feed into it, or through the openings in the manholes in the main sewer itself. The odor of illuminating gas escaping from a sewer would be decidedly noticeable long before sufficient gas to form an explosive mixture became present.

In the summer time, the temperature of the floors of garages and pavements of a city are at or above 50 deg. F., the vaporizing point of gasoline, so that any gasoline spilled on the pavements or on floors of garages would evaporate and mix with large volumes of air, in which condition it is not explosive, without ever reaching the sewers.

In the winter the reverse is true. The temperature of the pavements and the floors of garages is below 50 deg. F., so that any gasoline spilled is very likely to reach the sewers. The temperature of the water in the sewers varies from 40 to 60 deg. F., so that it is quite likely practically all of the gasoline which reaches the sewer is vaporized there. Since the specific gravity of the gasoline vapors is 1½ to 2½ times that of air, these vapors will follow the surface of the water and will not tend to escape from the trunk sewers through the lateral sewers and the manholes. During the winter, most of the pavements are covered with ice and snow. Any gasoline spilled on the pavements is frozen and becomes mixed with ice and snow so that when we get warm rainy days, the snow melts, thus releasing the gasoline. We may expect to find an unusual amount of gasoline in our sewer system following a heavy winter rain which at the same time forces large quantities of water and fresh air into our sewers. We may then expect to find the composition of our sewer gas to vary and contain unusually large amounts of oxygen which are necessary for the explosion. That is, the average sewer gas when mixed with any gas alone in any proportion could not explode, due to the high percentage of nitrogen and low percentage of oxygen.

We must have oxygen as well as gas or gasoline vapor present in a sewer to form an explosive mixture. To furnish oxygen, we must have fresh air, as air which has stood any length of time in contact with sewage is robbed of its oxygen. So we must expect these explosions to occur after a period of rainy weather. Dry-cleaning establishments use large amounts of gasoline in their cleaning processes, using this gasoline over and over until it becomes so dirty that it cannot be used any longer. The easiest way to get rid of it is to put it in the sewer. Analysis of sewage taken from some of the sewers has shown as high as 1 gal. of gasoline per 1,000 gal. of sewage. This is an extremely high content. If this were general, the amount of gasoline vapors in many sewers would be explosive at all times, if sufficient oxygen were present to allow the explosion.

MEANS of IGNITION

The streets of our cities are covered with a network of underground electric systems, such as telephone, electric light, street railway and power cables. Evidence of leakages in these underground electric systems is always present in the corrosion of water and gas mains by electrolysis. An electric spark due to this leakage would cause an explosion of any gas mixture which was explosive. Sometimes the side of a manhole cover is cut off to make room for a street car. A spark from the street-car wheel as it goes by the manhole may ignite the mixture. A fire engine passing over the manhole may drop a spark which will explode an explosive mixture. The flame from a lantern taken into a sewer by careless workmen may cause an explosion. A lighted match dropped carelessly on a manhole may cause an explosion. In fact, there are countless ways in which an explosive mixture may be ignited.

THE EFFECT OF CURVES IN SEWERS

Curves in the trunk sewers offer a resistance to the free flow of gases through the sewers, causing them to bank up at these points. Changes in cross-sectional area in the sewer have the same effect. At these points we may expect to find explosive mixtures in our sewers if they are present anywhere. If a means of ignition is furnished, the explosion occurs at these points where the explosive mixture is present. The primary explosion forces the gases through the sewers, putting them under pressure, in which condition a gas which under atmospheric pressure is not explosive, may become explosive. The ignition wave follows the pressure wave and as a result there is a continuous series of explosions throughout the sewer, until a point is reached where the gases present are no longer explosive.

HOW TO PREVENT EXPLOSIONS

It is a case of either elimination of the explosive gases or ventilation of the sewers. It is impossible to absolutely prevent leakages from illuminating gas mains getting into the sewers. It is impossible to keep sewers absolutely free from gasoline vapors. It is impossible to always economically eliminate curves in the sewers.

It is then more a question of ventilation. The openings in manhole covers are designed to do this. If they are allowed to become clogged up with dirt and snow, they certainly do not fulfill their mission. Manholes are usually at least one block apart. If there are sharp curves or change of cross-sectional area in a sewer between two manholes, it is most likely that explosive mixtures will be found. Then that curve must be ventilated. This may be done by means of a stack built inside of the curb line with a conduit running to the top of the sewer. If the natural draft is not sufficient to ventilate the sewer at the danger point, then it may be necessary to resort to artificial draft through this stack. If these danger points are not equipped with stacks, removing the manhole covers for a few hours during the rainy days of winter will no doubt provide sufficient ventilation to prevent explosions.

There need be no fear of a serious explosion in a straight-barrelled sewer at any time. There need be no fear of a serious explosion in any sewer during dry weather. Rainy days during the winter are the danger periods and if care is taken to provide sufficient ventilation at the danger points during these periods, the writer believes that sewer explosions may be eliminated.—Engineering News.

The Use of Hydrated Lime in Concrete Mixtures for Pavements

By Robt. S. Edwards

IT is the purpose of this paper to show wherein certain materials, when put together carefully and correctly, serve to make and meet beyond any question of doubt a pavement which has become a recognized standard under practically all conditions of cost, labor and materials. Such a pavement, when properly laid, has demonstrated itself to be permanent under all varying conditions of traffic.

Concrete pavements meet all of the above requirements, but the concrete pavements of the future must be so put together in their making as to leave no room for doubt to even the most skeptical. It is in this putting together of a concrete to be used for a pavement that the manufacturer of hydrated lime is bound to find an ever increasing demand for his standardized hydrate.

The utilization of concrete as a paving material during the last five or six years has developed into an extremely important business, and is destined to become one of the greatest, if not the greatest consumer of Portland cement. Concrete pavements are found in practically all states in the union, while the various counties of several states have practically standardized this pavement. Notable among these is the county of Wayne, which includes the city of Detroit, Mich. Since the inception of concrete road building in Wayne county, about five years ago, more than 70 miles of concrete pavement have been laid, and the county long ago adopted concrete as its standard pavement. As this county has placed more concrete pavements, and of necessity has had more actual experience in handling concrete pavements than any other section of the United States, it is interesting and instructive to know what its specifications call for and how experience has taught its officials to do their work.

1. Great care is taken in preparation of the sub-base. Experience has shown that more cracking in concrete pavements has resulted from improper and careless treatment of the sub-base than from any other one cause for cracking; consequently the sub-base is rolled hard and made as uniform as possible; also density is desired so that water seepage from the concrete into the sub-base may be diminished as much as possible.

2. Careful specifications for the sand, gravel or crushed rock and cement are insisted upon and carried out to the letter. Careful proportioning and mixing of the concrete are also done.

3. Within the last four years a gradual increase in the richness and thickness of the concrete has been specified and the present specifications call for a 1:2:3½ concrete mixture 7 inches thick for one-piece concrete pavement.

4. Care in protecting and covering all concrete after placing and keeping it covered for at least 10 days. This precaution is taken to prevent the loss of moisture by evaporation from the surface of the concrete.

5. The use of steel expansion joints cutting the entire depth of the concrete at each 25-ft. section and the filling in between these sections as formed, by pieces of felt.

Placing and treatment of concrete pavements under the above specifications have produced results which are very satisfactory, and in carefully analyzing these specifications it would seem that every particle of engineering and common sense had been used. In practically every step in the process of laying the concrete it has been the intention to carry on the work so that future cracking may be eliminated, yet in spite of all these precautions more or less cracking has developed and is generally attributed to settlement of the sub-base or the movement of the concrete, due to temperature changes.

From the writer's experience, gained in the testing of materials which go into concrete, as well as from experience acquired in the supervision of important concrete work and examination of so-called "concrete road failures," he does not believe that the fundamental causes for cracking in concrete pavements are temperature changes in the concrete or settlement of the sub-base alone. There are other primary and extremely important reasons why these so-called temperature and settlement cracks develop at a later date, and until we take proper steps and exercise due care to the right time, we cannot greatly reduce this excess cracking.

No specification for laying concrete pavement, to his knowledge, has taken into consideration the chemical peculiarities shown by Portland cement concrete in its preliminary setting and hardening periods. There has been no special provision for retaining to as large a degree as possible the actual mixing water first used in the concrete mixture. By careful treatment of the sub-base and protection of the finished surface of the concrete after pouring, it is the intent of the various specifications with which the writer is conversant, to retain in the concrete as much of this first mixing water as possible. While these precautions are a great help, they are not quite sufficient, as they rely to a great extent on treatment of surfaces to keep the water from leaving the concrete. The prevention of this leakage of water from concrete after the first few hours in which it is poured is an extremely important feature, and in this connection it is well to bear in mind that the reaction between a solid, such as Portland cement, and a liquid, such as water, is a surface reaction, water being able to react on the surface of the cement grain only, and that owing to the slowness of the reaction and the insufficient amount of water being present, only a relatively small amount of the Portland cement is at first decomposed by water. Consequently if we can actually keep within the concrete mass what little excess mixing water we start with, or introduce into the concrete mass in the mixing some substance that contains or will readily hold excess water which the cement may secure later, we shall accomplish what has not been done before.

There is no more important period in placing a concrete road surface than the first 24 hours after pouring the concrete, for it is in this period that minute spots of weakness generally develop, due to the loss of water by leakage and evaporation and use of water by the cement in setting, causing contraction in the first 24 hours. Upon the later permanent hardening of the concrete, we do not secure a slab of so great cohesive uniformity as would be expected on first consideration.

The general conditions under which concrete pavements are placed are severe, as the majority of work is usually done in the dry spring and summer months when temperatures are high, causing excessive evaporation. The concrete is generally poured on an earth or clay sub-base in a thin slab varying between 4 and 7 inches in thickness. This condition alone makes it almost impossible to secure uniformity throughout the concrete mass, so that after hardening the concrete road slab is subject to far greater variations, due to the segregation of the coarse aggregate from the mortar, than is found in other forms of concrete work. This, of necessity, causes unevenness throughout the concrete, and the excessive cracking and unravelling so often seen in poorly laid concrete roads is directly due to this fact.

It is the writer's opinion that the primary cause of cracking in concrete pavements is due to the loss or leakage of varying portion of the mixing water from the concrete by seepage through the sub-base, as well as by evaporation from the surface of the concrete, which leaves the concrete road slab in such a condition that at later times it will alternately absorb and give up water, depending on the season of the year, and that expansion and contraction of concrete and any movement in its volume are due infinitely more to this alternate wet and dry condition than to any temperature change from hot to cold without presence of moisture.

That the cracking which is directly attributed to the change in the condition of the sub-base, either in settlement spots or in drying out in shrinking, is primarily due to this cause, which is greatly helped by unevenness and variability of the concrete mixing.

The Use of Hydrated Lime

Hydrated lime is a product formed by the addition of accurate quantities of water to known weights of freshly burned quicklime, the finished material being a flour-like powder of great fineness and covering capacity, having more than twice the volume of the same weight of cement in its dry state.

The use of hydrated lime as a void filler in concrete mixtures, and for rendering concrete mixtures more watertight, dates back several years. Numerous tests show that a replacement of from 10 to 15 per cent of hydrated lime in rich concrete mixtures does not decrease the compressive strength of the concrete after three to four months' time, and ultimately increases the strength and permanence of the concrete. It apparently makes but little difference as to its action as a void filler, whether the hydrate is manufactured from a dolomitic or high magnesia lime or a high calcium lime—it being necessary only to have a produce which contains no free lime or unslacked particles. The proper hydration or dry slacking of lime reduces it to a finer degree of subdivision than can be accomplished by any mechanical means.

The amount of water required to convert the dry hydrated lime into a plastic paste varies from 50 to 70 per cent of the weight of the lime, while, to obtain a mortar of similar consistency with Portland cement, an addition of 25 to 30 per cent of water is required.

Unlike Portland cement, however, the addition of water to hydrated lime does not create any chemical reactions. There is simply a lime paste formed which holds its excess water for a long time. Upon the addition of small quantities of hydrated lime, amounting to 10 or 15 per cent, to the weight of cement used in concrete mixtures and the ordinary mixing of such mixtures, the hydrate, which has absorbed a large amount of water, corresponding to its weight, is thoroughly disseminated throughout the concrete mass, and, due to its fine plastic conditions, it is forced immediately into places in the concrete which the cement cannot reach.

Concrete, so mixed, on leaving the mixer, flows more readily into place and the coarse aggregate has much less tendency towards segregation in the concrete mass. In other words, the extremely finely divided condition of the moistened hydrated lime paste has increased, to a marked degree, the covering or spreading quality of the cement, and reduced, to a similarly marked degree, the friction between particles of fine and coarse aggregate.

This answers the question "Why does hydrated lime benefit concrete?" The action is purely a mechanical one, and can be compared to the oiling or greasing of a shaft or bearing. The property which hydrated lime has of absorbing and retaining large percentages of water offers a ready solution to the problem of finding a means for keeping and holding moisture in freshly poured concrete pavements until the slower-acting cement-hardening process can utilize it.

It is obvious that small percentages of hydrated lime, when added to concrete mixtures, in road work, will accomplish the following things:

1. Renders the concrete highly plastic and homogeneous, thus producing density and uniformity in the finished concrete. This condition adds much to the life and efficiency of the road because of the uniform resistance to wear and other stresses.

2. Keeps a certain amount of excess moisture in the concrete while setting.

3. Renders the concrete mass more nearly watertight, thereby preventing the alternate wetting and drying out of the finished concrete.

4. In large pieces of work, these properties given

to concrete by hydrated lime would materially reduce the labor in spreading and bringing the concrete to a uniform surface, which is of great importance in paving work.

Analysis of Factory Building Costs

THE accompanying diagram, reproduced from the Cement World, indicates approximately the proportionate distribution of cost factors in the construction of a typical modern reinforced concrete factory building, by the Aberthaw Construction Company, of Boston, Mass. The building is 150 by 50 ft., with brick curtain walls and interior construction of reinforced concrete. The two lower floors were designed for live loads of 250-lb. per square foot, and the upper floors for 150-lb. loads. The diagram is divided into two parts, denoting the proportionate cost of materials and labor, respectively.

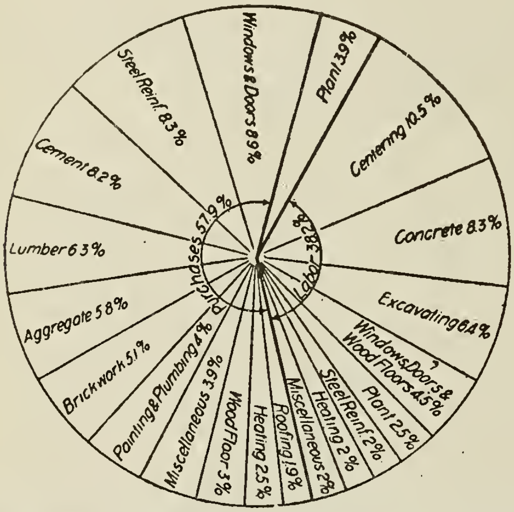


Chart showing proportionate cost of the construction of a typical reinforced concrete factory building.

The popularity of hollow tile is due principally to the fact that the clay which is used is more carefully prepared, harder burned, and used where it will do the most good, comments The Architect and Engineer. Since these walls and webs of well manufactured clay perform all necessary functions in carrying loads and resisting strains, the balance of the wall may as well be void. The voids are cheap. They require no clay. It costs nothing to dry and burn them. The railroad and cartage men transport them for nothing. They do not tire the hod carrier or brick mason. No steel is required to support them in the wall, and they are very good non-conductors of heat, cold and moisture. It is this economy from the clay pit to the finished wall that makes hollow tile popular.

The United States army engineers have long used the following mixture in waterproofing cement: One part cement, two parts sand, three quarters pound of dry powdered alum to each cubic foot of sand. Mix dry and add water in which has been dissolved three-quarters of a pound of soap to each gallon. This is nearly as strong as ordinary cement, and is quite impervious to water besides preventing efflorescence. For a wash, a mixture of one pound of lye and two pounds alum in two gallons of water is often used.

Constructional Miscellanea

Renewal of the holding-down screens in the Cincinnati filters may be eliminated entirely, thus saving a heavy outlay for replacements, if further experiments corroborate those already made to learn whether or not the screens between the gravel and the sand may be omitted. A report on the present condition of the Cincinnati waterworks states that the brass wire screen is gradually going to pieces from corrosion. Extended tests made by J. W. Ellms, superintendent of filtration, with an experimental filter and with two of the large filters thus far are quite promising and indicate a heavier and deeper gravel layer will take the place of the screens.

Plans and specifications were approved recently by the Board of Public Commissions for a three-million-dollar pressure tunnel through rock on zero gradient in connection with the St. Louis sewer system. The scheme involves four large drop shifts at the upper end by which three thousand cubic feet per second in storm flows is diverted from the existing sewers and introduced into the tunnel. The average drop will be forty-five feet, and the length of the relief sewer is to be twenty thousand feet, of which two thousand feet will be reinforced concrete sewer in open cut, and eighteen thousand feet of 16½ x 16½ feet neat concrete lined tunnel, nearly all limestone.

A difference in water density at the lower ends of the Miraflores and Gatun locks at Panama has developed a current of probably three or four miles an hour under certain conditions. At the stage of a downward lockage, when the surface of water in the lower chamber has been brought down to evenness with that in the approach, the water within the chamber is more than half fresh. In consequence it has less density than the sea water beyond the lower gates, and when the gates are opened the heavier water thrusts its way inward against the lighter, causing a current opposed to the outward passage of a vessel. The current being temporary causes no serious inconveniences, and is being studied principally to determine accurately the conditions for the manipulation of the towing locomotives.

Bending reinforced rods is accomplished very simply and satisfactorily at Balboa by an arrangement somewhat similar to the rail-bending machine. The rods are bent by the thrust of the piston rod of an engine cylinder while the rods are held in place on a table in front of the cylinder. The table is a steel plate bored with numerous holes, wherein are placed movable steel pegs for limiting the bending. Two such equipments are in use; one includes a single 10-in. cylinder recovered from an old French locomotive. This outfit places a single crimp in three or four ¾-in. rods simultaneously. The second equipment employs two 14-in. cylinders taken from the dumping mechanism of a 2 cu. yd. concrete mixer, which are mounted on opposite sides of the table and make opposite bends in rods as large as 1¼-in. in diameter. In both cases, compressed air is used at a pressure of about 80 lb. per sq. in. It is claimed that five men in one hour can bend as many rods as they formerly did in eight hours.

An artificial island of reinforced concrete has been built in the Mediterranean at Hyeres Strait, near Toulon, the great French naval base, which is to be used solely for testing torpedoes. The island is not a large one, being less than 80 feet long by about 50 feet broad, and is built upon a reinforced concrete caisson which was towed out from Toulon and submerged. It is divided into compartments by walls 4 feet thick, in the largest of which, 10 feet below the sea level, the torpedoes are handled. Projecting from this compartment are three torpedo tubes, while above the surface of the water, 10 feet in the air, are two aerial-torpedo tubes. The operating mechanism, which uses electricity as a motive power, is all contained in the superstructure built over the caisson, and lighting and ventilating systems, as well as wireless and searchlights are provided. An electric crane extending out from one side permits the torpedoes to be lifted from the water and returned to their stations after practice.

Ventilation—Artificial or Natural

By Paul W. Goldsbury, M.D., Warwick, Mass.

To secure a texture of air indoors that more nearly resembles that outdoors is the ambition of sanitary engineers who have anything to do with buildings or their construction. To live indoors and still enjoy some of the purity of the air that is to be found in the open is a matter of vital concern to the average worker, for the greater part of his day is passed under roofs and inside walls. Civilized man has been dwelling in his house for ages, adding comfort to comfort with apparently little regard as to what such confinement cost him in health and vigour. His eyes, however, have been suddenly opened, and that within a bare generation, for he has seen and known of the response which the "white plague" sufferer has made living under clear skies. He is learning something of the connection between the shut-in-ness of his office, shop, and sleeping apartment and his occasional ills and ailments. He is being persuaded that where the real sick are doing so well there must be something worth while for him in the air tinted and coloured by the sun and toned and perfumed by lake and stream, forest and field.

The human race has always needed shelter; a roof is wanted in all climates, either to protect from the rain and snow, or to shield from the light and heat of the sun. The play of the elements and the changes of temperature require walls also set so close as to shut away winds and cold. The house has been divided into compartments. Rooms afford individual privacy or establish limits necessary for business or housekeeping interests. In a thousand and one ways has the home and the school, stores, factories, and all sorts of buildings been made snug, comfortable, or divided up so as to anticipate every little thing which has to do with usefulness and service. The occupants have been protected from the struggles of the elements out of doors, and the changes of the seasons, and the structures have been more and more adapted and furnished and made to serve the man in his work, his studies, his whims, his pleasures. But the finished, the complex building is seen more and more to complicate and obstruct the free circulation of air. Man is so occupied with his art, his craft, his own creation, that he has forgotten the physical breath of life. The genius of the scientist and physician, the skill of the engineer and builder, all added to the concern and diligence of the janitor, have not met satisfactorily the problem of fresh air. The patient sufferer of tuberculosis, though compelled to be still, has been forced to listen to the stiller voices of Nature, and learned lessons from her heart and ways which must become known everywhere.

All sorts of ventilating systems have been used and devised to introduce, purify, moisten, and change the air. To continually bring the large quantity of air necessary in factories, schoolhouses, and large public buildings, to wash out the dust, to heat, and at the same time keep up the humidity, entails an expense which seems prohibitive in the case of smaller buildings and dwellinghouses. The demands for sufficient moisture where cloth fabrics are woven have long been realized and have been met by the introduction of elaborate apparatus for humidifying the air. The popular recognition of the demands of the human fabric for moisture comes long after. To heat, to moisten, to remove the dust, and to supply the quantity of oxygen considered necessary for each individual, is only tackling a part of the problem in giving him the kind of air he needs. Students who were endeavoring to serve the public in providing better ventilation have met with success in a measure. Things might have been worse. They have had to fight organized greed and that race for wealth and competition which produces crowding and congestion, a tide very difficult to stem. These students, in the practical application of the results obtained in the laboratories, have been preparing the way and educating the public in ventilation. But it remains for those compelled to live in the open to carry forward such labours. Man's workshop is always more or less restricted, but the laboratory of Nature has practically no bounds.

How many people can be herded and boxed up together and not impair both their own health and the efficiency? The summer camp furnishes a marked contrast to the stuffy office and the winter apartment as to the tonic qualities of the free and fragrant air. Many of the newer banking and trust company offices show an evidence of a concession to that elemental fact that breathing space is necessary. The height of their ceilings seems to indicate something of a protest against the low-ceiled rooms of the day. It must be also a matter of good business policy to afford the high officials of such and other large institutions elbow room on all sides where they have important affairs to transact. Precision in work and clarity in mind and thought must be nourished by a generous amount of atmosphere. There are virtues in the high-vaulted cathedrals in the space afforded the heated and fouled air to rise and escape.

Two hospitals about the city of Bostón have found quite a helpful suggestion from a very primitive source of architecture which they have adapted to their own needs. The Indian tepee emphasized some very ordinary lessons in physics. The Indian is said to live in his own chimney; at any rate, he has more or less fresh air coming in the doorway or under his walls, and much of the bad air must, of course, follow the natural drift, rise and escape with the smoke of his fire at the apex. Windows are seldom kept open at the very top of a room, and even if they were the ordinary ceiling is horizontal, so that there are pockets or large spaces where the air is not changed. If the ceiling or roof slopes, then the air as heated tends to flow upward all the time from the rooms to drift into that uppermost space (in this case about 8 ft. across), under the ridge running the length of the building between the gables at the ends of the roof. In fact, that part of the roof is raised so as to allow windows to be put in on the other side. One is immediately struck in going through these buildings, particularly if any windows are opened below and above, at the freshness of the air. The currents from the ordinary levels to those under the apex of the roof seem to establish such a circulation that even the harmful odours and gases are wafted upward and entirely out of the building. When the air is still outside, that from within will come out of the windows opened on both sides of the roof. But with a wind, those on the leeward side, away from the direction from which the wind comes, only are opened. In that way, instead of the air being driven back in at the roof, it is sucked out. The genius of the white man has gone the Indian one better on that point. Of course, in such an arrangement the quantity of air passing in and out requires an extra amount of heat, but there are compensations. The response of the patients treated in these sanatoria seems to warrant the added cost of fuel.

In a broad study of all these considerations of purity of air and ventilation, one reaches the conclusion sooner or later that health is a matter of space, of variations in the character of the air, and that unobstructed nature is a master teacher in these arts. Consider how the movements of the sun, the rotation of the earth, produces the changes in temperature, and add to these the outlines and area of land and water, hills and valleys, all the geographical and topographical considerations which affect the direction of air-currents, their moistness and dryness. The earth in its geological out-croppings and chemical strata affect the air "electrically," one might say. The life of the woods, the fields, the sea, add to the character and aroma of the air. By all these forces playing in and out freely, Nature can present all sorts of faces and moods; she revitalises the atmosphere by gentle or more abrupt gradations. Can artifice approximate all these physical variations?

The hospital structure above described, with ample grounds about it, should be thought of as at a stage about midway between the regions where the elements are free and untrammelled and the pretentious office building in the heart of a large city. In the latter no expense may be spared to introduce air from a strata or level beyond the range of the ordinary pollutions of the atmosphere. Such air may be further washed and cleansed, moistened and heated, but imagine it in the long and circuitous channels and conduits through which it is introduced into the building as robbed of many of the virtues which it may have possessed. The walls of this long route must more or less taint it or cause it to lose its varying character. It must seem to the occupants to have pretty much the same smell all the time. Is it actually or only scientifically pure? Scientific men are already coming to recognize that some of the standards formerly set up as necessary for a safe atmospheric condition are not so absolutely essential. Air may even have a high carbon dioxide content and not be so injurious, providing it is not in so stagnant a condition, but is subject to waves and currents and shows variations which react upon the skin and sensory nerve fibres, giving evidences of tonic and harmonic changes. Air must be conceived of as offering continuously impressions to the nose and skin, which gauge its value.

The problem of ventilation is rendered more and more complex where there is crowding, where the natural is replaced by the artificial. The trend of city development, the skyscraper, makes fresh air costly. Health is very costly, but life, after all, can not be valued. Is there not, then, an impassable wall in city life? Must not the city sooner or later disintegrate in favor of the country? Health must in the end be the measure of real efficiency. The artificial must bow sooner or later to the natural forces. The laboratory student, with all his earnestness, zeal, and ambition in this behalf, has not as much at stake as the poor invalid who has to take to the woods for his life. The sensibilities of the latter are keyed up to protect his waning vitality, and may register discoveries beyond the delicate instruments of the former. Nature in all its nakedness and wildness must more and more be courted when and where it can best develop those sensibilities.

In all this, Nature but compels man to return to her own side for instruction and life. Man has placed his laboratory too near the market place, too near congested centers, and, though he must study these conditions at close range, his scientific vision becomes blurred—the atmosphere, the fumes, the fret of the environment hammer are too much upon his perceptions, and so warp his conceptions, his results. He must know the life and various complications by experience. His conclusions, taken from one side, are sure to include error. His viewpoint must be ventilated, clarified by some of the lessons which those compelled happy for the life and all it affords and are desirous of sharing the good things.

A New Toronto Warehouse

Construction work is almost completed on the new warehouse which is being erected for Mr. George Greisman, on the northeast corner of Richmond and Duncan streets, Toronto. The building is mill construction and consists of five storeys and basement. The exterior of the structure is of red plastic brick. It occupies a frontage on Richmond street of 101 feet and on Duncan of 99 feet 6 ins. In the construction provision has been made for the renting of the building in separate floors and each floor is so constructed that it can be occupied, if required, in whole or in part. Stairways and elevators are provided in the centre of the building, thus affording communication with either end. The heating installation is the Spencer self-feed system throughout and the building will be equipped with elevators, both passenger and freight, of the Otis-Fensom type.

The general contractors are the Standard Structural Company, Limited, Toronto. The contract for the brick work was carried out by Mr. J. A. Williams, Toronto. Sand-lime brick for the interior of the building was supplied by the Harbor Brick Company. The Don Valley Brick Works supplied the ornamental brick and the Milton Pressed Brick Company, Limited, had the contract for the buff pressed brick. The carpentry work is being carried out by the general contractors; the heating and plumbing by John Ritchie Plumbing & Heating Company, Limited; the electric wiring by Rice, Green & Company, Limited; and Keith's Limited are installing the sprinkler apparatus. The roofing, which is ordinary tile and gravel, was constructed by J. Van Sickler & Company, Limited. The contract for the painting and glazing is being carried out by Mr. E. Hoffman; the window glass was supplied by the Toronto Plate Glass Company, Limited; the window frames by H. M. Lickley, Limited; steel and metal sashes were supplied by the A. B. Ormsby Company, Limited; the concrete sills were manufactured and supplied by Cement Products, Limited; beams and columns by the Boake Manufacturing Company, Limited; and sand, etc., by the York Sand & Gravel Company.

The building, which will be ready for occupation about the end of August, will cost about $75,000. The architects are Messrs. Chadwick & Beckett, Toronto.

The Foundation Problem in Building Construction

THE foundation of a building is the first part of its construction, and by far the most important to be made exactly right. Big engineering propositions of foundations for skyscrapers and extremely large buildings are always taken care of by capable engineering research and application, and have been discussed at length by the technical press from time to time. What we are calling attention to now is the foundation problem of the cottages, the more pretentious residences, or other smaller buildings, of which there are immense numbers, and which constitute the larger part of all construction as well as the main consumption of all building materials.

Let us look at the foundation problem fairly and squarely. It is customary, when a man intends to build a bungalow, to look for the very cheapest material possible for all that part of the building which is underground, because it does not show. As such foundations have a very insignificant load, almost anything is sufficiently strong to carry it.

Fifteen years ago twenty-four-inch rubble stone walls, laid in lime mortar and having a footing of double sized rubble stone, was the standard foundation for such buildings. Such basements were invariably damp, and it made very little difference whether the frost got under the footing or not, because there was enough "give and take" in the irregularity of the bearings of the rubble and the soft mortar, to take up any ordinary frost heave, or to conceal the cracks that were the results of minor settlements in the foundation walls, where the footing happened to rest on soft spots of earth or on shifty sand.

At the present time the most popular foundation for such a building has come to be the 12-inch concrete wall, which, when properly made, is just about as nearly a perfect proposition for the purpose as can be devised; but not one out of a thousand is properly made. The contractor who takes the job generally figures from the plans of an architect who has never seen the lot and who assumes that the grade line will represent a level surface of the ground. He shows excavations amounting to a depth of 4 feet, so as to give a 6-inch margin. The ground slopes to one corner of the building in nearly every case, so the excavation on the low side will be no more than 6 inches or 10 inches. In fact, it may not extend through the black loam of the surface, and at that corner the building is entirely unprotected from the attacks of frost.

The contractor cannot afford to furnish any more material than he has figured to use in the foundation, for more than likely he has taken the job so as to simply make his own wages by putting in the foundation. Should he deepen the trench on the low side, and add three additional yards of concrete to his foundation, it would amount to his wiping out all the profit as well as his wages for putting in the foundation. The result is that the foundation as put in may be short of cement, but even when there is plenty of cement put into the concrete, the work is done so cheaply that the contractor cannot afford to mix the concrete properly. It is usually just a case of shoveling in some crushed rock, along with a little sand and a little cement to make a spongy, porous concrete which is not worthy of the name and not fit for any structural use.

Naturally, such a foundation has to be daubed up with plaster on the outside, then it has to be treated with all manner of waterproofing compounds and devices to keep the soil waters from penetrating the wall and so making a wet basement. In spite of all the precautions of waterproofing, close to one hundred per cent. of all such foundations are damp, are wet, and will always be unsatisfactory.

Notwithstanding all that has been published and said by technical men on the subject of mixing concrete and making it wet enough so as to puddle the moisture to the surface, very little puddling of concrete is ever really done. The main dependence for securing solidity by the usual foundation contractor is the weight of the material when it is shoveled into the forms. True, the workmen may walk backward and forward, stepping on the material, and so tamping it down with their weight, but it is incomplete, insufficient and unsatisfactory. If this is not remedied it is quite certain that there will be a return to the use of rubble stone for foundation purposes, which will keep the concrete man out of a very large portion of the business which he now enjoys.

Let us assume that all the materials to make good concrete are assembled on the job, still it takes some additional assembling to that of the materials. It requires sufficient water, and water is not always the easiest thing to obtain on a little foundation job. When the weather is very hot, and the water has to be hauled in barrels or in a tank wagon, there is a very pronounced tendency to skimp on the water, just as there is to skimp on the cement and in every material that is in the work. There is no substitute for water or for adequate mixing in a concrete job.

Half of the contractors who put in residence foundations proceed by the following method: They will spread out on a mixing board, or on the ground a yard of crushed rock. On top of this they will spread half a yard of sand; on top of the sand they will spread, fairly evenly, four or five bags of cement. Then they will throw on a few buckets of water and immediately begin to shovel the entire mass into the forms, without any pretense of turning it over or mixing it, claiming that the stuff is all loose and wet and mixes as it goes in. They claim that it is impossible to keep it from mixing, and consequently, there is no use to go to the expense of paying men to shovel several tons of material two or three times, when it can be done with one shoveling.

This mixing proposition is very seldom improved upon, even when there is a small hand mixer on the job, because it is somewhat of a back-breaking undertaking to grind the crank of a hand mixer, and the laborer who has this part of the work to do does not care a rap about the quality of the material he is producing, and every turn that he can avoid is carefully avoided.

There is no question whatever but that a good solid foundation made of concrete, well mixed, well tamped and properly proportioned, will be just about as tight as a jug. If it extends down to 3 feet 6 inches below natural grade it will be just about as safe from frost and in every way as nearly perfect a foundation as can be secured.

When the excavation for a foundation extends 3 feet 6 inches, or even 4 feet below natural grade, it will not be impervious from an attack by frost, unless the back-filling of dirt against the foundation, when finished, is well rammed into place and the dirt piled up a little higher immediately so as to throw the surface water a few inches away from the building.

It would be difficult to estimate the amount of money involved in the damages to buildings where lack of depth of the footing allows the frost to go under the building.

There is an idea prevalent among even experienced contractors that loose dirt from the excavation can be piled up against the foundation of the building and so built up to make the 4-foot depth to their footing. Made ground is not a protection against frost until it has had from thirty to thirty-two winters, even though the footings are placed as deep as sixteen feet in made ground.

The writer recently observed the foundation of a building resting on made ground which extends ten feet below the grade of a modern street. The total filling, however, amounts to about twenty feet. Last winter the frost penetrated into the made ground and got beneath the footings, which were ten feet below the present grade, and raised all four corners of that building so that extensive repairs were necessary during the present summer. In fact, made ground never becomes as solidly stratified for the resistance of moisture as the stratification of the natural surface of the earth, and this is why we always use the expression of "natural grade."

Made ground should never be considered as having any value in the placing of the footing of a building. A 3-foot 6-inch or 4-foot excavation below the surface of the natural grade does not indicate that the penetration of frosts in severe winters is limited to that depth. Penetrations of frost into the ground have been found seven and even eight feet. But it does mean that in the usual construction of buildings the quantity of moisture that penetrates through the various earthly strata to the depth of three and one-half feet is not sufficient to form a crystalline arch of ice which by contraction and expansion disturbs the footing of the building.

The surface drainage of the building at completion naturally becomes an important matter, for if rain water is kept away from the wall it will not go under the foundation. The owner should always be cautioned with regard to his responsibility in keeping the walls, especially those of a new building, from standing in water while the fall rains are soaking into the whole surface of the ground, because when the frost period comes this water in the soil will be the vehicle upon which the frost travels to go underneath the footings and destroy the superstructure.

There is no unknown factor to the problem about the construction of a perfect foundation for the buildings of the class mentioned, but there is a very great difficulty in securing the construction of such a foundation which is positively good. The services of a capable architect are very often cheap where they result in the securing of a good foundation. No architect has performed his duty to his client unless he has provided a foundation which will go down deep enough below natural grade to protect it from the frost danger and dense enough to protect it properly from the seepage of lateral pressures of water.

There is no necessity for a wet or damp foundation, nor is there any occasion for a foundation that heaves with the frost; because it is simple enough to have it extend at least three feet six inches below natural grade, at all parts of the building, and to have the dirt filled in and thoroughly tamped. Then have the outside of the building drained carefully for a year or two, or until the dirt immediately against the foundation has had a chance to assume something very near its former consistency when in its natural state, before the excavation occurred.

The practical foundation men who read these lines will find something which, if applied, is well worth the space devoted to this article.—Rock Products.

The cost of unloading gondola cars was materially decreased at the Aberdeen, S.D., sewage disposal works according to W. G. Potter in a paper on the plant presented recently before the Western Society of Engineers, by rigging up a block and tackle so that a drag scraper could be pulled lengthwise of the car, dumping at the end over a trap into a Koppel industrial car beneath. The material was 175 car loads of broken stone for the sprinkling filters. By hand the work cost 45 to 65 cents per yard, a figure cut to from 19 to 24 cents per yard. A switch track enabled cars to be placed adjacent to the filters. The total average cost was 32.4 cents per yard. Laborers were paid 25 cents per hour.

All bent bars shown on reinforced concrete drawings should be given some reference mark, which should consist of capital letters and numerals, or numerals only. The following scheme is suggested: For the first ⅜-in. bent bar mark it 300, the second 301, and so on; mark the first ½-in. bent bar 400, and so on. For ⅝-in. bent bars use 500, ¾-in. use 600, and so on. The hundredth figure will indicate at once whether the bar is a ⅜-in. bar or a ⅞-in. bar; thus 703 would indicate that ⅞-in. bars are to be bent and probably it is the fourth in the series of ⅞-in. bars having different bends.

Any attempt to economize in the cost of reinforced concrete by cutting down the proper weight of steel is excessively foolish. In a case recently reported, the attempt to save $1,000 on the steel in a $45,000 contract reduced the factor of safety by 25 per cent.

Safeguarding Buildings Against Fire

Essential Features of Construction Designed to Prevent Spread of Flames—Importance of Sprinklers and Waterproofed Floors

By Alfred Ludwig

IF a building be so constructed that the confinement or stoppage of a fire at the point of its origin can be accomplished, the problem preventing heavy fire losses is practically solved. To achieve this object it is essential:

First.—That every avenue by which fire can spread from storey to storey, or building to building, be protected or cut off.

Second.—That floor areas open to the spread of fires be made as small as possible.

Third.—That combustible material entering into the construction of buildings be made a minimum.

First.—Fires, in order to make headway, must have fuel and oxygen, and without the latter must soon die out. If there be unprotected openings in buildings, in the floors and walls, a draft will be created quickly, the hot air rising and the cold air rushing in providing the necessary oxygen for the combustion of the fuel. It is therefore evident that in order to confine a fire to the point or place of its origin, no opening, however small, in either the walls or floors should be neglected, for, as long as it provides an avenue for the hot air to escape, a draft will be created and the fire will spread. A building with unprotected floor openings partakes very largely of the nature of a stove, the flues being provided by the elevators and stairway wells, the stock and contents being the fuel.

Many of the buildings, even though of comparatively recent construction, are designed apparently as if the intent were to provide as many means as possible for the spread of fire, little or no provision having been made to protect properly the stairway, elevator or window openings. At the present time, however, the hazard of unprotected floor opening is appreciated fully by the students of fire protection, and great advance has been made in providing adequate protection in this direction. Most of the building codes of recent enactment have covered this important subject fairly well. The same, however, cannot be said in regard to the hazard of the unprotected window and other openings in walls of buildings, which is equal to, if not of greater importance than, that of the floor openings.

The treatment of this hazard in most of the codes and laws has been very unsatisfactory. It is true that some provision has been made for the protection of window openings thirty feet or less, but no provision has been made for protecting the upper storeys in buildings from the spread of fire through the windows from fires originating in the lower storeys. Experience has taught that unprotected window openings are one of the most prolific sources by means of which fires can spread, and it seems strange that so little consideration has been given to this subject. Possibly the reason may be attributed to the prejudice of the public against the use of wireglass as obstructing light, and in part to cost, and this has had its effect on our lawmakers. The first reason is in the main without weight. The amount of light obstructed is practically negligible in the case of clear, plate wireglass. After being accustomed to the wiring one ceases to find it objectionable. The cost is more serious, but it would seem that the public welfare should receive the first consideration.

Exposures facing streets adjacent to buildings are hazardous in the extreme, yet no provision of the present-day law recognizes this important fact. Fires occurring in buildings will break through the front quickly (and this is especially true if the wind is in the right direction), and be communicated to the adjacent premises, unless the wondows be protected.

As buildings become of greater and greater height the problem of window protection becomes more and more important and necessary. The stories of a very large percentage of fires demonstrated the ease with which fires are transmitted and spread through unprotected window openings. The secret of adequate fire protection consists in making each storey of a building a fire section, cutting off every means by which fire can be communicated to it from the other storeys.

In order to obtain the maximum security in buildings, the window and floor openings should be a minimum, for the greater the number of these be, the greater the number of avenues provided through which fires can spread, and the greater the number of vulnerable points that must be protected. Even with the best of protection, window and floor openings are always weak spots in the protective armor of buildings. Doors in the enclosures at stairways and elevators may be left open, or they may fail to close, or the enclosure itself may yield to the attack of the flames, or the window protection fail and permit the flames to spread to other storeys.

The statement that the number of stairways should be a minimum may not be in accord with the ideas of many, who at this time are advocating more and more stairways in buildings to facilitate the exit of the inmates from buildings in time of fire or panic. This purpose can be accomplished to far better advantage, and with greater safety to the inmates, by a freer use of fire walls and less stairways. By means of fire walls the various storeys of a building can be divided into fire sections, and through protected doorways the inmates can escape from the danger zone to safety in the adjoining section.

In connection with the problem of protecting life in buildings, it may not be inappropriate to call attention to one most important phase of this question, and that is panic. Many persons who are advocating an increase of the number of stairways in buildings have rushed to the conclusion that the large loss of life in buildings in recent fires is due mainly to lack of exit facilities, and they seem to be of the opinion that few, it any, lives would have been lost if adequate exit facilities had been provided. A careful study of the facts in each case where large loss of life has occurred, apparently by reason of fire, seems to point to a panic among the inmates as the real reason, and not so much to lack of exit facilities.

When a panic occurs reason is lost, and all rush to escape at once, generally resulting in blocking the exits, the strong beating down the weak. Again, under these conditions, it is extremely difficult to distribute the inmates so that each exit will take care of its proportionate share.

Since panic is produced by a state of mind, no safeguard that can be provided in buildings can be effective against it and prevent loss of life. It is therefore almost useless to multiply the stairways and open up new ways by which fire can spread. Fire drills and education only can be effective.

As previously pointed out, stairways, even when protected, are liable to be sources of danger. They should, therefore, be placed as far as possible in fire towers, access to the several storeys being by means of exterior balconies. Communication between the several floors is thus practically cut off.

In protecting stairway and elevator openings the enclosing walls should be constructed of brick, terra cotta, concrete (cinder or stone) or other approved fire resisting material not less than eight inches in thickness, with self-closing, solid Underwriter fire doors, hung with strap hinges at openings. Wireglass panels should not be permitted in these doors. Since light, air and ventilation are necessary in most buildings, window protection can best be secured by means of automatic standard Underwriter fire windows, glazed with wire-glass. While standard fire shutters, if closed, may give better protection against fire, yet the impossibility of keeping them closed during work hours, and the difficulty in closing in time of danger, due to excitement, militates largely against their use as a means of efficient protection except in ware or storage houses and other buildings where light is not essential. On the other hand, wireglass windows are always ready for service, and if provided with a fusible link will close automatically in case of fire.

Second.—In order that fire losses may be as small as possible it is important and essential that areas included in any fire zone be limited. Large, unrestricted floor areas, containing in many cases values running well into the hundreds of thousands of dollars, are only too common in nearly all the great cities of the country, and they furnish a condition pregnant with the possibilities of heavy fire losses. A fire occurring will spread quickly over the entire area, destroying thousands of dollars' worth of stock; in addition the damage by water is greatly increased.

By means of fire walls the fire zones can be restricted greatly, and fire losses curtailed. In addition these walls serve another purpose in providing a means to protect life by furnishing additional exits in time of stress. It is just as essential to provide fire walls in fireproof as in non-fireproof buildings, since the stock can become fuel for a fire just as readily in one case as in the other. Both classes of buildings should be treated alike in this respect.

While there are provisions in our laws to restrict floor areas in non-fireproof buildings, practically no limitation is placed when buildings are of fireproof construction, the idea being apparently that, since the building itself is incombustible, its contents must be equally so.

The whole subject of fire walls in buildings has never received the consideration that its great importance merits, and it is to be hoped that future laws will remedy the failure of the past.

While fire areas should be as small as possible, it is recognized that the exigencies of modern business must be taken into consideration and a compromise made with the opinion of the fire expert. It would seem that a limitation to 5,000 square feet of floor area in unsprinkled, and an increase to 7,500 square feet in sprinkled, risks is not asking too much of the property owner.

Third.—The next essential requirement in the defense against fire is that the use of combustible or inflammable material in the construction of buildings be restricted as far as possible. This is especially necessary in connection with the exterior of buildings, which should be of such a character that no fuel be provided upon which a fire can feed. Combustible store fronts, bay and show windows, signs, roof structures, and also, as far as possible, window frames and sash, doors, etc., should be eliminated.

The large amount of combustible material that has been permitted in the past to enter into the construction of the exterior of buildings, or to be placed on the roof, or to be attached to the sides, has provided a means for the rapid spread of fire from building to building, and in consequence increased the possibilities of a conflagration. This latter danger would be almost negligible if the exterior of buildings were of fire-resisting materials and all exterior wall openings protected.

SPRINKLERS

In the foregoing discussion an attempt has been made to point out the essential features that should enter into the construction of a building in order to confine a fire to the place of its origin. If, in addition, a standard equipment of automatic sprinklers be provided, it would appear that the last word has been said in protecting buildings agains the ravages of fire. No means as yet devised equals in effectiveness the automatic sprinkler in confining or stopping a fire at its source. The sprinkler is always on guard, and its work done before a fire ordinarily can gain any headway.

Economic reasons will militate largely against the universal use of the automatic sprinkler, and it is hardly to be expected that in buildings of a private or semi-private nature compulsory installation of the sprinkler can be enforced; yet, on the other hand, there are many buildings of a public character, such as factories, workshops, lofts, warehouses, places of assembly, etc., where large quantities of combustible materials are used or stored, or where large numbers of people work or congregate, in which the installation of the sprinkler could be required by law.

WATERPROOFING FLOORS

There is one other subject that may be touched upon in discussing ways and means to prevent fire losses in buildings, and that is the waterproofing of the floors of buildings. It is a well-known fact that a very large percentage of the annual loss attributed to fire is due to water used in fighting fires. In many instances the loss due to water damage may be greatly in excess of that due to fire. Water thrown on fires in the upper storeys of buildings finds its way through the ordinarily pervious floors to the lower storeys, damaging stock, plastering, decorations, etc. If more attention were paid to waterproofing floors and providing proper drainage, a very large reduction in the annual fire losses would result.

CONCLUSION

It would appear that in the battle against fire three lines of defence are indicated:

First.—Fire should be prevented, as far as possible, by means of the effective enforcement of fire prevention laws.

Second.—Fires that occur in spite of fire prevention laws should be confined or stopped at the point of origin. This can be accomplished most efficiently by means of the installation of a standard equipment of automatic sprinklers.

Third.—If the sprinkler line of defence fails to confine or stop the fire, it should be confined to the storey or building or its origin. This can be accomplished by protecting all windows and floor openings, and by curtailing the use of material of a combustible nature in the construction of buildings, and especially on the outside thereof. If buildings are protected as outlined the danger of a conflagration is practically eliminated.

Curious Building Laws of Ancient Times

H. B. McMaster Brings to Light Some Surprising Historical Facts

It has been estimated by the underwriters that 27 per cent of the fire loss in this country comes from fires that extend beyond the buildings in which they originate, so stated Mr. H. B. McMaster, Commissioner of the Associated Metal Lath Manufacturers in a recent paper before the Up-to-Date Club of Youngstown, Ohio.

A reasonable conclusion is that these losses are due to the inflammable construction of our buildings.

To correct this a proper building code should be adopted in every state and municipality.

Mr. V. D. Allen, City Inspector of Buildings at Cleveland, was good enough to place at my disposal, Mr. McMaster continued, the result of his research into the history and evolution of building laws. Among other things he found that from the Jews came this effort at Code building:

"One who builds a new house must erect a battlement around the roof so that no person shall fall from it. The battlement must be at least ten fist-breadths in height, and must be well constructed so that one may lean upon it without apprehension. To guard against injury, one must not leave a well or a pit on one's premises uncovered, nor must one keep a vicious dog, or a broken ladder. It is forbidden to walk alone at night, to stand under a wall that is like to fall, to walk upon a poorly constructed bridge, to enter a ruin, or to drink in the dark from a well lest some poisonous animal lurk in the water."

It is within the range of reason to expect that a building inspector with small fists must have been popular with builders in Jerusalem.

"Sky-Scrapers" Popular B. C.

In the days of Solomon, there were buildings ten storeys high. One rabbi tells of climbing 100 feet to his room. Herodotus tells us there were houses in Babylon four storeys high and Greek historians report many houses in ancient Tyre ten storeys high. Athens had a building law limiting the height of buildings for residences to ten storeys.

About the year 325 A.D., when Constantine, the Roman emperor, determined to establish his capital on the Golden Horn, he built a wall across the peninsula as the limits of his city and the dividing line between city and country taxes.

Speculators from all parts of the empire rushed in and bought up land, raising real estate prices over 300 per cent within a year.

High buildings were the logical outcome of this condition and the capitalists sent to Rome for architects who could design higher buildings, with the result that in ten years the new capital rivalled Rome in this regard.

Constantine, finding the view of the city and bay obstructed by these higher structures before he could complete his palace, issued an edict forbidding buildings more than 100 feet high.

A wail went up from the speculators but the tops of the buildings had to come off and it is recorded that one block lost the four upper storeys which would indicate that there were buildings from 125 feet to 135 feet.

Evaded the Laws Then as Now

It is related that one Apothagos built a row of houses between the royal palace and the sea. They were of stone and brick as required by law and within the limits of 100 feet, but on top of this he built frame structures of three storeys. The royal "inspector of buildings" ordered these frame superstructures removed, but Apothagos, claiming it was only a temporary structure for housing his workmen while they completed the building, went into court with it. After ten years of litigation, the superstructures were torn down, but all this time royalty was much offended by the unsightly buildings which stood between it and the sea.

It is interesting to learn that every tenant in a Roman tenement had to look to his own security. Therefore, at dark all doors were barred, windows secured, and in the better class buildings a watchman was hired from a common fund. Sometimes two such watchman were provided, one of whom was chained fast at the front door.

The Incendiary Nero in a New Light

The average person having the belief that Nero was an imperial incendiary will be apt to suffer a shock when he learns that a most comprehensive and practical fire prevention building code was formulated and enforced by this ruler whose name is heard more often in obloquy than in praise.

Some historians say Nero's act of burning Rome in the year 64 A.D. was not without design; that it was, in fact, an efficient way of removing buildings to make way for a great city plan. However this may be, it is a fact that a better order of things resulted. Ruins were hardly cold before the working population of the city were set to work clearing away the debris, and the royal architects, without regard to former ownership, laid out avenues, squares and parks on a grand scale. A law was enacted that no residences should be higher than twice the width of the adjacent street. This seems to be the earliest record of provision for limiting the height of buildings with relation to the width of the street on which they faced. Tenement houses were required to be isolated, and the two or three lower storeys had ceilings resting on stone or brick arches, wood construction being permitted in upper storeys only.

We learn that in front of every home the owner was required to erect a wooden portico to protect the passers-by from the rain and sun.

It was a magnificent city that Nero began, but after his death in the year 68 A.D. his ambitious plans were ignored or forgotten; the public squares were sold to speculators and high tenements along narrow streets again became the order.

In later times we learn that Venice limited the height of buildings to 70 feet, Florence to 180 feet, Paris to 60 feet, and Toledo to 75 feet.

Rheims had a curious law forbidding any structure to be higher than the eaves of the Cathedral, and it was the duty of the sexton to look daily from the port holes of this Cathedral when a building was being constructed to see that it did not rise higher than the level of his eyes.

Practically all ancient and mediaeval building laws dealt with residential structures, since the problems of office and industrial buildings were reserved for this age to deal with.

The removal of septic tank scum after it has become ripe was advocated in discussion by W. D. Gerber at a recent meeting of the Western Society of Engineers. If the scum is not removed it turns into a leathery gelatinous substance and finally much of the material drops to the bottom and is difficult to remove.

A report issued by the Austrian Society of Engineers and Architects gives the results of an investigation conducted by the Committee on Reinforced Concrete appointed by the Society. Facts, rather than theories, were kept in view throughout. Thus, the results obtained, which may some day lead to the evolution of a theory, serve in the meantime to establish facts of much value to practical constructors. The degree of fixity to be allowed for in the expression of the bending moment and in the design of reinforcement for resistance to negative bending moments is one of the most delicate questions for consideration by the designer. While the ends of reinforced concrete beams as usually applied are not supported freely, the condition of perfect fixity is rarely attained. Therefore the observations made relative to the extent to which the ends are fixed under various practical conditions are of high interest. One of the most remarkable points brought out in the course of the investigation is the fact that the resistance of beams stiffened by gussets or knee braces at the ends is seven times greater than that of beams uniform in cross section throughout.

Life in Epigram

By Ernest O'Neal

Reputation is seeming; character is being.

Reputation is manufactured; character is grown.

Reputation is your photograph; character is your face.

Reputation makes you rich or poor; character makes you miserable or happy.

Reputation is what men say you are; character is what God knows you are.

Reputation is what you need to get a job; character is what you need to keep one.

Reputation is what comes over you from without; character is what rises up from within.

Reputation is what you have when you come to town; character is what you have when you go away.

Reputation is what is chiselled on your tombstone; character is what the angels say about you before the throne of God.

Underground-Conduit Developments in Montreal

Substantial progress is being made in conduit construction in Montreal under the supervision of the Montreal Electric Commission, which was organized by an act of the Quebec Legislature of 1909 for the purpose of removing all overhead wires in the city with the exception of trolley contact wires. The commission consists of Dr. L. A. Herdt, of McGill University, chairman; Mr. R. S. Kelsch, representing the various public utility companies in the city, and Mr. de Gaspe Beaubien, representing the Quebec Utilities Commission, all being consulting engineers charged with the broad supervision of the problem of underground-conduit construction, the operation and maintenance of such structures, and the taking over of existing overhead lines and conduits in the establishment of a comprehensive system. The work being done at Montreal is one of the first instances where a municipality of 500,000 inhabitants has embarked upon a program of such scope upon the basis of a legislative act, and it is of particular interest in relation to the engineering and operating problems involved.

The members of the commission were appointed in 1911, and the first meeting of the board was held in the fall of that year. Additional powers necessary to give the commission complete control of the wire situation in the city were obtained from the Legislature in 1912, and the latter part of that year was occupied in engineering work involving studies of underground-conduit problems in Montreal and elsewhere and the preparation of plans, specifications and contracts for the initial installation. Construction was begun in the spring of 1913, and at present work is being pushed along the two major axial thoroughfares of the city, St. Catherine and Bleury Streets. About 687,000 feet of duct have been laid in the former and 180,000 feet in Bleury Street and Park Avenue. In general the main conduit consists of 3½-in. square tile duct, 3½-in. fiber duct being used in the construction of the laterals and services. The district at first to be covered consists roughly of an area about 3.5 miles long and 1 mile wide, including the business center and adjacent residential sections.

The commission will lease its ducts to utility companies upon a duct-feet basis not yet announced, and similar systems of transmission and distribution will be placed in adjoining ducts. The rental will be set at a figure which will cover all fixed and operating charges on the conduit system. An initial appropriation of $5,000,000 has been granted the commission, and all plans and specifications are approved by the Public Utilities Commission of Quebec before the award of contracts. The last-named body also acts as a board of arbitration in case of an appeal by any party in interest. Neither the city nor any company has the present right to install overhead wires, the Electrical Commission having sole jurisdiction over all wire and conduit work. It is believed that this arrangement will greatly reduce the burden of street openings experienced in cities of large size in which conduit is installed and maintained by the companies.

Plans are now being prepared in the offices of the board for placing underground wires throughout the entire business district. In general, three types of manholes are to be used—drain manholes, placed at street crossings and intersections; service manholes, usually 250 ft. apart, and containing connections for from two to six service pipes, depending on the demands of the local buildings, and transformer manholes. A maximum of thirty-two ducts per conduit has thus far been installed, and it is expected that cable pulling will begin early in the present month. The Bell Telephone Company of Canada maintains its own system of conduits by a charter provision, but all other utilities, including the local railway, power, telegraph and signalling systems, are to lease appropriate space in the city duct system. Contracts are awarded for various sections of the work upon a purely competitive basis. Occupants of buildings taking service from the companies using the ducts are required by ordinance to have their buildings wired to permit an underground service entrance in each case.

Three years ago, when the White Star liner Olympic entered the North Atlantic service, the only drydock in the world capable of taking her was at Belfast. Now there are five, all of them in British territory, namely, at Liverpool, Southampton, Bombay, Singapore and Belfast, while in another year or two there will be three in Canada, at Esquimalt, B.C., Halifax, N.S., and Quebec.

Personal Mention

Mr. A. W. McConnell has received an appointment as Assistant Professor of Architecture in the University of Toronto.

Mr. R. L. Dobbin was appointed recently to the position of waterworks superintendent for the city of Peterboro, Ont. He has been identified with water supply undertakings in various parts of Canada and was associated with the construction of the Moose Jaw supply line from Caron, Sask.

Major R. W. Leonard has retired from the National Transcontinental Railway Commission, after a service of two and one-half years. An Order in Council has been passed transferring the duties of the Commission to the Minister of Railways, in accordance with a recent Act of Parliament.

Mr. Thomas H. Hooper has been appointed operating superintendent of waterworks at Winnipeg. He will have charge of water distribution, care of mains, connections and services, and all repairs. For nearly fifteen years Mr. Hooper has been manager and chief clerk in the city's engineering department.

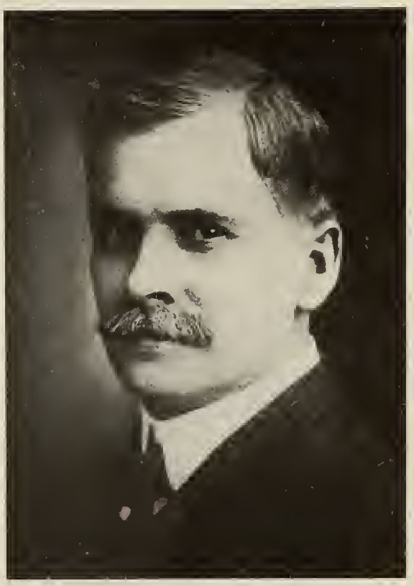
Mr. A. N. Johnson, Chief Engineer of the Illinois Highway Commission, has resigned to accept a position on the Bureau of Municipal Research at New York. Mr. Johnson is a member of most of the prominent American engineering societies. He has taken a great interest in convention work and many of his papers have been reproduced from time to time in the columns of this journal.

Mr. Paul Schioler has been appointed bridge and structural engineer of Winnipeg in the newly organized engineering department. Mr. Schioler was an assistant engineer on the Panama Canal in 1905-6 and in the following year was resident engineer on an important engineering undertaking in South America. He was assistant engineer in the Department of Public Works of Manitoba from 1907-8. In the latter year he entered the service of the city, since when he has been engaged in bridge construction work.

At the 24th Annual Convention of the Canadian Electrical Association held in Montreal (June 24 to 26) the following officers were elected for the ensuing year: President, Col. D. R. Street; First Vice-President, Mr. D. H. McDougall; Second Vice-President, Mr. R. M. Wilson; Third Vice-President, Mr. Wills MacLachlan; Honorary Secretary, Mr. T. S. Young; Secretary-Treasurer, Mr. Alan Sullivan, Toronto. Managing committee:—Messrs. J. S. Gould, Smith's Falls; G. W. Mâgalhaes, Toronto; P. T. Davies, Montreal; H. G. Matthews, Quebec; A. E. Dunlop, Pembroke; J. S. Norris, Montreal; George Kidd, Vancouver; Robin Boyle, Niagara Falls; W. G. Angus, Hamilton; W. S. Robertson, Toronto; E. L. Milliken, Sydney, N.S.; L. W. Pratt, Hamilton; H. R. Mallison, Montreal; H. Hulme, Montreal.

Mr. Bion J. Arnold, Chicago, Ill.

NOT a few of our readers will be interested in an informal introduction through this column to Mr. Bion J. Arnold, consulting electrical engineer, of Chicago, whose report on "The Traction Improvement and Development of the Toronto Metropolitan District" and whose valuation of the Toronto Street Railways are matters of recent history. Mr. Arnold was born in Michigan in 1861 and was educated at the University of Nebraska and at Hillsdale College (Mich.), taking a post-graduate course at Cornell University. After acquiring a general experience in the various branches of engineering work, Mr. Arnold turned to the field of electricity and decided upon making that his particular profession. He has devoted his attention largely to the construction and operation of electrical railways in which he has accomplished numerous distinct advantages. Being early impressed with the value of storage batteries in connection with electric traction work, he set himself to perfecting plans for their use. One of his earliest successes in pioneer electric railroading was the equipment of the Chicago and Milwaukee electric railroad with a sub-station storage-battery and rotary converter system, using high tension alternating current for power transmission, which proved a great success and has since become the standard type of construction for inter-urban electric roads, having reached its highest state of development in the system put into operation by the New York Central Railroad. That road commissioned him in 1901 to study and report upon the feasibility of electrically operating its trains in and out of New York City, and for the five years following he was a member of the commission in charge of electrifying over three hundred miles of the road's track, which, with the terminal in New York City that the changes necessitated, involved an expenditure of over $60,000,000. In 1902 he was engaged by the city of Chicago to make an exhaustive study and report upon the entire traction system within its limits and in four months he produced a 300-page report embodying a scientific analysis of the entire proposition so complete with arguments and statements of facts that his recommendations were adopted and formed the basis of a comprehensive system of surface, elevated and underground railways later developed by him as chief engineer.



Mr. Bion J. Arnold, Consulting Engineer, Chicago.

During the last decade Mr. Arnold has been called in to report upon some of the most difficult traction situations and transportation problems in the United States. Coming down to recent times, he was engaged in 1910 to report on the Pittsburg transportation problem. As chief subway engineer for Chicago he prepared and presented plans for a passenger subway system for the city. Los Angeles, Providence, San Francisco, and many other cities too numerous to mention have requisitioned his services. One of his most complete reports—the preparation of which involved over a year's work, was on "The Improvement and Development of the Transportation Facilities of San Francisco." Last fall, Mr. Arnold was engaged by the Citizens' Terminal Plan Committee to report on the steam railway terminal problem of Chicago and his recommendations constitute what is probably the most complete study of the kind ever made. Mr. Arnold continues to act as Chairman of the Board of Supervising Engineers of Chicago Traction. In this capacity since 1907 he has directed the expenditure of some $85,000,000 by the surface street railway lines of Chicago.

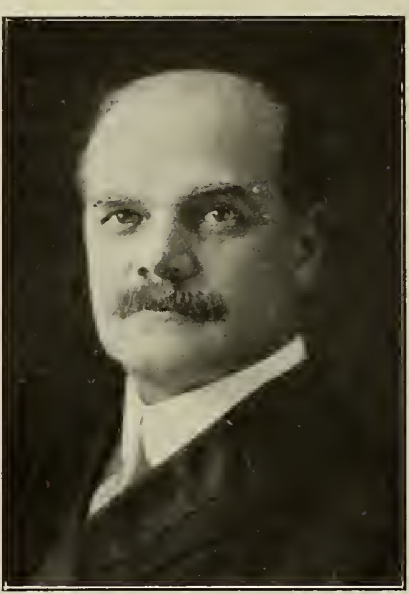
J. W. Evans, Belleville, Ont.

THE present City Engineer of Belleville, Ont., Mr. J. W. Evans, is one of the city's own sons, he having been born there in 1870. He was educated at the Belleville and Trenton public and high schools and at the School of Practical Science, Toronto. Mr. Evans proceeded to the study and practice of his profession under Mr. John D. Evans. From 1890 to 1893 he was Assistant Engineer for the Canadian Copper Company, Sudbury. Upon giving up this work he practised engineering for three years in the firm of Mickel & Evans. From 1896 to 1898 he was Chief Engineer of the Brandon and South Western Railway Company in which capacity he undertook the preparation of plans and surveys on the line from Brandon to Deloraine and Waskada. His experience was broadened by putting in a couple of years in charge of construction for the contractor of the Central Ontario Railway extension from Ormsby Junction to Bancroft. He was Chief Engineer of the Bay of Quinte Railway for six years and was also Resident Engineer of the Rathbun Company and Town Engineer of Deseronto. In 1903 he built the line from Napanee to Deseronto, and, in the two years following, that from Tweed to Bannockburn. Mr. Evans was engaged in the private practice of his profession at Cobalt from 1906 to 1910, and at Belleville, in the firm of Evans and Evans, from 1910 to 1914. He was appointed City Engineer of Belleville and manager of the waterworks there in April last.

City Engineer Evans, of Belleville, Ont.

Professor Brydone-Jack, Winnipeg

ONE of the best-known men in the profession in Western Canada at the present time is Ernest Edmund Brydone-Jack, Professor of Civil Engineering in the University of Manitoba. His academical post would appear to be a fitting avocation for the son of a former president of the University of New Brunswick. Professor Brydone-Jack was born at Fredericton in 1871. He graduated from the University of New Brunswick with the degree of B.A. in 1891 and from the Rensselaer Polytechnic Institute (Troy, N.Y.) with that of C.E. in 1894. Passing over a varied experience in railroad work, bridge work and general designing, we find him Professor of Civil Engineering and Dean of the Engineering Faculty in the University of New Brunswick from 1901 to 1905, during the greater portion of which period he held the office of City Engineer of Fredericton. He became engineer-in-charge of detail designing for the Virginia Bridge & Iron Works and later accepted an appointment as Professor of Civil Engineering in Dalhousie University at Halifax, N.S. He was engaged in private consulting work from 1905 to 1907, during which period he was Secretary-Treasurer of the Nova Scotia Society of Engineers. He succeeded to his professorate at the University of Manitoba in 1907 and has carried on private consulting work in conjunction with his academical duties from that time to date. The wide scope of Professor Brydone-Jack's activities may be gathered from the fact that he was Chairman of the Traffic and Transportation Committee of the Winnipeg Town Planning Commission in 1911; that he was a member of the Council of the Canadian Society of Civil Engineers from 1910 to 1913; that he was Secretary of the Manitoba Branch of the Canadian Society of Civil Engineers from 1907 to 1913; that he is the present chairman of the Manitoba Branch of the Canadian Society of Civil Engineers; that he has held a seat on the council of the University of Manitoba since 1910; that he is a member of the Province of Manitoba Board of Examiners of Architects, and that an enumeration of many more of his associations might be made. He holds membership in the Institute of Civil Engineers of Great Britain, in both the Canadian and American Societies of Civil Engineers and in the American Institute of Consulting Engineers.



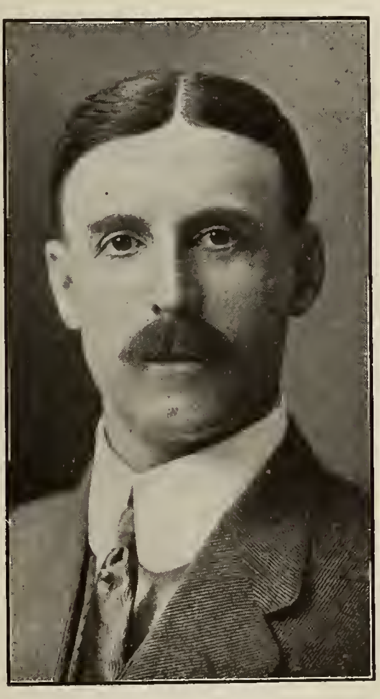
Mr. E. E. Brydone-Jack, Consulting Engineer, Winnipeg, and Professor of Civil Engineering in the University of Manitoba.

Mr. William F. Farley has opened an office at 43 St. Francois Xavier street, Montreal, where he will conduct a general engineering practice. Mr. Farley was formerly Assistant Engineer with the Ambursen Hydraulic Construction Company of Canada, Limited, and the Raymond Concrete Pile Company of Canada.

Mr. M. J. Butler, President of the Canadian Society of Civil Engineers, and Mr. P. A. Gagnon, accountant, have been appointed by the Montreal Board of Control to report on the proposed expropriation by the city of the Montreal Water and Power Company's system.

Strong Contracting Organization at Saskatoon

A new Western engineering and general contracting organization is the firm of Richardson Builders, Limited, Saskatoon. Brief mention of this company will be found of interest owing to the fact that the members of the firm are well-known Western men who have gained distinction in other capacities. The personnel of the company is Mr. E. A. Richardson, president; Mr. G. T. Clark, vice-president and engineer; Mr. Chas. Curtis, secretary, and Mr. Henry J. Keith, treasurer. The president, who hails from Nova Scotia, was formerly superintendent for the Geo. H. Archibald Construction Company, of Winnipeg, for whom he had charge of a number of important contracts, including the Maple Leaf flour mill at Kenora, Ont., the Western Canada flour mill at St. Boniface, Man., and the $250,000 departmental store of J. F. Cairns at Saskatoon. Later he became City Commissioner at Saskatoon, but resigned in favor of the more congenial office of President of Richardson Builders, Limited. Mr. Clark is known to many of our readers as the former city engineer of Saskatoon, he having held that post from 1909 to 1914. He severed the city connection to become general manager of Western Pavers, Limited, an office which he retains together with his vice-presidency in the Saskatoon company. The Secretary, Mr. Chas. Curtis, is well-known as a former Toronto man and as President of Western Pavers, Limited. The Treasurer, Mr. Henry J. Keith, holds similar office in Western Pavers, Limited. The firm received signal encouragement in obtaining the first work upon which they tendered—and not at the lowest figure, either—the contract for the students' residence of the University of Saskatchewan, at Saskatoon. The contract for this building was awarded to Richardson Builders, Limited, at $185,000 and the work will be finished at Christmas. It is the firm's intention to specialize on government and civic work, office buildings and warehouses. In predicting a successful business future for this new organization, we do so confident in the enterprise which has made individual successes of its members in the past.



Mr. E. A. Richardson, President Richardson Builders, Limited, Saskatoon.

Mr. Geo. T. Clark, Vice-President Richardson Builders, Limited, Saskatoon.

Obituary

Mr. M. M. Reynolds, Vice-President of the Grand Trunk Railway, and who for many years had charge of the financial and accounting departments, passed away recently.

Mr. E. S. Morrison, who lost his life recently in the Fraser River, B.C., at a point one hundred and forty miles north of Kamloops, was engaged as resident engineer of construction for the Canadian Northern Railway at Blue River.

Mr. T. H. Parr, whose death is announced at the age of 66, was a native of England and entered the engineering department of the city of Winnipeg after coming to Canada. He was engaged in private practice as civil engineer and surveyor at Victoria in 1890 and two years later was appointed assistant city engineer of that city under Mr. E. A. Wilmott, a position which he held for many years. For some time prior to his death the late Mr. Parr was not actively engaged in the pursuit of his profession.

Mr. Alexander Stewart, formerly assistant chief engineer of the Great Northern Railway, died in Seattle, Wash., recently. Mr. Stewart was born in Dalhousie, N.B., and his first position of importance was that of provincial surveyor of Manitoba. Later he was appointed chief engineer of the Duluth & Winnipeg road, now the Great Northern, with headquarters at Winnipeg. He went to Seattle in 1904 as assistant chief engineer, a post which he held until recently when, following a serious illness, he was appointed consulting engineer to be at hand on all important projects.

Mr. James L. Taylor has transferred his services from the position of road superintendent for the County of Wentworth, Ont., to a similar post in Parry Sound.

Vancouver Reports "Gradual but Perceptible Improvement"

Office of the Contract Record,
Vancouver, July 2, 1914

To those who are at all familiar with current conditions in the constructional field at Vancouver and other important Pacific Coast points, the second half of the present year holds out the promise of a gradual but perceptible improvement in the building situation. After many protracted delays, arrangements have been practically concluded for starting operations on a number of outstanding projects of high valuation, chiefly in the neighborhood of Vancouver, and it is safe to assume that the additional activity thus created will have a decidedly beneficial effect on the general outlook for development work in this province. It is a significant mark of confidence in the future of the territory in which it operates that the B. C. Electric Railway Company, the largest single corporation in the province, is preparing to increase its transportation facilities by undertaking the construction of immense new car barns at Vancouver at an expenditure of fully $350,000. Another indication of confidence in the stability of the commercial capital is provided by the decision of the Canadian Bank of Commerce to proceed with the erection of a new branch office building, costing about $75,000, in the east end of the city. In addition to these extensive undertakings, contracts have either been let recently, or will be awarded shortly, for the construction of the first unit of the new University of British Columbia, costing about $500,000; three new post offices with an aggregate cost of $385,000; addition to the Vancouver General Hospital costing $75,000; Central School at North Vancouver, to cost over $116,000; Grandview drill hall, representing an outlay of over $350,000, and a number of other important structures.

IMPORTANT VANCOUVER PROJECTS

Tenders Invited for University Unit

The recent action of the Board of Governors of the University of British Columbia in calling for tenders for the first unit of the proposed constructional scheme was hailed with satisfaction in Vancouver building circles where the impression appears to exist that proposals will soon be invited for additional sections of the work. The initial construction planned in connection with the University group is the Arts and Science building, for which there is an appropriation available of $500,000. According to an announcement from Hon. Dr. Young, Provincial Minister of Education, it is the intention to invite tenders at an early date for two Dormitory buildings and an Administration building, the total outlay on all four structures approximating $1,500,000. All of the buildings will be reinforced concrete structures—the design of Messrs. Sharpe & Thompson, architects for the University.

In all probability a permit will be issued at Vancouver during July for a three-storey branch building which the Canadian Bank of Commerce propose to erect this year on their property at the corner of Main and Pender streets. It is understood that plans of the structure disclose columnar treatment on the two street frontages which are to be constructed of stone. Brick will be used for the two remaining elevations. Provision has been made for offices in the upper storeys and the cost of construction will be approximately $75,000.

Construction work is proceeding steadily on the new addition to the Vancouver General Hospital, known as the McGill Block, to be used for the present by the authorities of McGill University and to be utilized later for hospital purposes. The building measures 150 x 50 feet and will be three storeys in height. It is of reinforced concrete and brick construction, representing an outlay of about $75,000, and it is being erected by Booker, Campbell & Whipple, after plans by Mr. A. A. Cox, Vancouver.

Work is now in progress in connection with the new car barn which the B. C. Electric Railway Company is erecting at Vancouver between Main and Quebec streets. The company owns an entire block of land at this location and has a car barn on the north half with accommodation for sixty cars. The new building, which will occupy the southern portion of the block, will be two storeys on Main street and one storey on Quebec street, the lower elevation on the latter street being possible on account of a rise in the grade. The new structure will provide for one hundred and twenty cars, thus enabling the company to take care of one hundred and fifty cars at one point. The interior dimensions of the barn are 130 x 304 feet. It will be of reinforced concrete throughout and is estimated to cost about $350,000. As the ground is low lying, the entire building will be constructed on piles, and the building will be erected one-half at a time. The excavation for the southern half is already completed and retaining walls extending along the Quebec Street and Fourteenth Avenue frontages have been erected. About 25 per cent. of the piling is in place and operations are progressing for the footings of the concrete piers. Westinghouse, Church, Kerr & Company are the contractors and architects for the work.

SCHOOL CONSTRUCTION PLANNED AND UNDER WAY

Provincial Normal School a Noteworthy Building

The Provincial Normal School at Victoria, upon which work has reached an advanced stage, is without exception the most noteworthy example of school construction in British Columbia. The building occupies an ideal location on a seven-acre tract at the corner of Richmond and Lansdowne Roads, and is being erected with a view to providing the province with an establishment where the educational facilities and general equipment will equal that of any similar institution in the country. The general contract for this work was awarded to Luney Bros., of Victoria, in the latter part of June, 1913. Since the commencement of active construction last July, the progress of operation has been all that could be desired, despite the time occupied at the start in excavating the foundations from solid rock. The structure will be thoroughly fireproof, it being of reinforced concrete construction with facing of red pressed brick and trimmings of Denman Island stone, with slate roof. The most commanding feature of the design is a central clock tower, 95 feet in height, whose base merges into the elevation of the principal entrance. The main entrance will be finished in terrazzo tile and the interior of the auditorium will be carried out in plaster decorations. The stone work on the exterior has been practically completed by the contractors, who, at the same time, have the slating and plastering well in hand and are about to commence operations in the interior of the building. The rock used in the concrete was the material taken from the excavation and crushed on the job.

Included in the equipment will be a system of low-pressure steam heat; exhaust ventilation; vacuum cleaning plant, gas plant, wood block floors throughout, automatic temperature control, electric time system, inter-communication telephone system, and a full equipment for the various rooms and departments on the different floors.

On the lower floor there will be a gymnasium, 73 x 35 feet, recreation rooms, heating and fuel chambers, store rooms, lavatories, bath and dressing rooms, plunge and shower baths for both sexes, luncheon rooms, masters' rooms, cycle rooms, games and storage rooms, janitor's rooms.

An auditorium, 73 x 35 feet, with gallery, platform, ante rooms, etc., four students' class rooms, three model scholars' class rooms, principal's and teachers' rooms, two music rooms, secretary's office, cloak and locker rooms, library, store and stock rooms, lavatories, etc., will occupy the ground floor.

On the first floor will be situated four class rooms, clay modelling, art, science, lecture and preparation rooms, optical dark room, biological, chemical and physical laboratories, balance and stores rooms, science master and assistant science master's rooms, lavatories, etc.

A feature on this floor will be a section devoted to the study of domestic science, including lecture room, a laundry, dressmaking and sewing rooms, cookery department, and a complete living suite, with two bedrooms, dining room, etc. On the first floor will also be rest and sick rooms, a room for medical stores, etc.

Mr. W. C. F. Gillam, of Vancouver and Victoria, is the architect for this fine school, the cost of which is expected to run into about $400,000. It is believed that the entire building will be completed well within the time limit specified in the contract—December 31 next.

The general contract for the proposed Central School building at North Vancouver has been awarded to W. J. Smith, Limited, Vancouver, whose tender amounted to $116,112. The design of this school, which was prepared by Mr. W. C. F. Gillam, of Vancouver and Victoria, provides for a structure 204 x 140 feet, consisting of reinforced concrete frame, brick and tile walls, with trimmings of Haddington Island stone, interior tile partitions and slate roof. The excavating contract is in the hands of Mr. F. McLellan, who has the work under way.

It is understood that contract tenders will be invited early in July by the Vancouver School Board for the first unit of the Strathcona School, which comprises a nine-room fireproof building, two storeys in height and of reinforced concrete construction with brick and stone facing. It was intended in the first place to erect a 24-room structure, but the original plans have been revised to provide for a 16-room building of which only a section, containing nine rooms, will be proceeded with at present. The amount of this contract will probably not exceed $80,000.

Competitive plans for a proposed 8-room fireproof school building are being invited by the Point Grey School Board and a number of the leading architectural firms in Vancouver have designs in course of preparation.

Luney Bros., of Victoria, were recently given the contract for the proposed Margaret Jenkins School at Hollywood, Victoria, the amount of their tender being $44,200. This building will be of the usual fireproof type with reinforced concrete frame, brick walls and stone facing.

The Victoria School Board has now available the sum of $155,000 for new construction work and it is quite probable that tenders for another new structure, the proposed Hillside School, will be called at an early date. According to the estimates of the board this school will represent an expenditure of approximately $80,000.

The municipality of Saanich, near Victoria, contemplate the construction of a new school and a by-law providing $45,000 for the purpose has been introduced in the local council.

PUBLIC WORKS DEPARTMENT CONTEMPLATES HEAVY BUILDING PROGRAMME

Leading Structures Described

Among the many important buildings projected in this province by the Dominion Department of Public Works are three sub-post-offices of substantial size and attractive design, two of which will be located in Vancouver, while the third is to be established in South Vancouver. Tenders closed at the end of June for erecting the proposed sub-post-office on the corner of 15th Avenue and Main Street in the Mount Pleasant district, Vancouver. This building will measure 73 x 88 feet and will be of reinforced concrete construction with stone and brick walls and marble wainscotting in the public space on the main floor. A marble staircase will lead from this floor to the offices in the next storey and the equipment throughout will be of the very latest description. The sum of $100,000 has been appropriated for the work, designs of which were prepared by Mr. A. Campbell Hope, Vancouver.

It is learned on good authority that plans are nearly completed for a new postal station and office building to be erected on the property recently purchased by the federal authorities at the corner of Gore and Keefer Streets, Vancouver. While there are no building details available at present, it is practically certain that the constructional features of this edifice will conform in a large measure with those of the Mount Pleasant structure, and that active construction will be undertaken this summer. The cost of this building has been estimated at about $250,000.

Plans are being prepared for the new South Vancouver post office which is expected to cost about $35,000. According to the limited details at hand, this will be a reinforced concrete building with brick facing and stone decorations.

According to Mr. R. F. Green, M.P., plans are under way for a new post office in Revelstoke and tenders will be invited immediately following the completion of the designs.

The Dominion Government intends to proceed with the construction of a new public building at Prince Rupert this year and has laid aside for the purpose a sum of $200,000. Tenders for this structure, which will be of reinforced concrete construction and five storeys high, closed on July 6. Granite will be used for the front elevteion and the remainder
Granite will be used for the front elevation and the remainder
are 100 x 100 feet. The ground floor will be paved in mosaic tile and terrazzo will be used for the three succeeding floors. Accommodation is to be provided for post office authorities, customs, telegraph, marine and inland revenue departments and for the Resident Engineer of the Public Works Department.

In point of size, cost and architectural beauty, the new drill hall which the Department proposes to erect in the Grandview district of Vancouver, is one of the most important works contemplated in the province. Messrs. Perry & Fowler, a Vancouver firm of architects, are responsible for the design of the building, tenders for which closed at the end of June. The construction will consist of brick and steel and the structure will have frontages on three streets with entrance on each. The extreme measurements are 278 x 174 feet and the cost has been estimated at something over $350,000. Adjoining the drill hall proper, a well-lighted apartment, measuring 225 x 120 feet on the main floor, will be company armories and officers' rooms. The first floor is to be occupied by the officers' mess, warrant officers' mess, sergeants' mess, lecture rooms and other quarters. The basement will accommodate swimming pool, gymnasium, miniature rifle ranges and bowling alleys, store rooms, etc. Accommodation is also provided in the building for the office of the brigadier and two band rooms.

Operations are expected to commence at an early date in connection with the proposed third class, reinforced concrete Detention Building to be erected by the federal government on Digby Island at Prince Rupert. This structure will be two storeys high and 200 feet in length and will be provided with accommodation for 100 people. Tenders for the work closed at Ottawa during the first week in July.

Building Prospects at Victoria

The contract for the first unit of the Royal Jubilee Hospital buildings at Victoria having recently been awarded to the B. C. Construction and Engineering Company, there seems every likelihood that tenders will be invited at an early date for the main section of the hospital and that construction work will be started some time this year on the main building scheme, involving an outlay of close to half a million dollars. The initial part of the work, for which the figure of the successful tenderers was $26,200, includes a brick power-house and laundry buildings. Tenders are new being taken for the erection of the power-house shaft, which will be 125 feet in height and of either brick or concrete construction. The hospital plans were prepared by Mr. Loring P. Rixford, of Victoria.

Another important contract—that for the proposed First Presbyterian Church—has been let to Stevens Bros., a local firm, their figure being $53,000. This building was designed by Mr. J. C. M. Keith.

Heisterman, Forman & Company are the owners of a block of six one-storey store buildings to be erected in the near future at the corner of Fort and Government streets at a cost of approximately $25,000. The outside measurements of the block, which will be of brick construction, are 60 x 60 feet. Mr. C. E. Watkins, a local architect, prepared the plans.

The municipality of Esquimalt, adjoining Victoria, intend to start work this summer on a municipal hall and fire-hall, building plans of which were prepared recently by Mr. Thos. D. Sedger, of Victoria. Construction work will be carried out in brick at a cost of about $25,000.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

For asphalt pavements at the Federal capital, the Ottawa Construction Company have secured a contract for work totalling nearly $100,000.

The American La France Fire Engine Company, of Canada, Limited, has been incorporated with $50,000 capital. The head office is in Toronto.

The Cadwell Sand and Gravel Company's plant has sustained a loss of about $8,000 in a fire which broke out in the Curling Club's building at Windsor, Ont., recently.

Campbellton Development, Limited, has been incorporated with a capital of $45,000 and head office at Campbellton, N.B, for the construction of public and private works.

The Hall Engineering Works, Limited, has been incorporated with chief office at Montreal and a capital stock of $200,000, to carry on the business of engineers and general contractors.

The Laval Quarry Company, Limited, was incorporated recently to carry on the building, contracting and manufacturing trades. The head office is at Montreal and the capital stock $49,000.

At Halifax, N.S., the construction of a mile of sea-wall 45 feet high from the bottom, and raised on two immense piers, is about to be commenced. The work will cost approximately five million dollars.

The incorporation of Gardiner & Gaskill, Limited, with a capital stock of $40,000 and head office at Montreal, is announced. The operations of the new concern will be those of general contractors and builders of railroads and bridges.

The building permits issued at Montreal during the six months ending June 30 last totalled $8,521,910, as compared with $9,942,285 for the corresponding period of last year. The June, 1914 and 1913 totals were $1,943,596 and $2,278,424 respectively.

The experiment of oiling the streets to lay the dust is about to be undertaken by the Fort William city council. With this object in view a carload of 50,000 gallons has already been purchased. The oil will be used on central streets which are not paved.

The Ontario Concrete Post Company, Limited, was incorporated recently with head office at Brantford, Ont., and a capital of $40,000, to manufacture reinforcements for concrete posts of all kinds. The provisional directors are David William Henry, Willoughby Staples Brewster, George D. Heyd, Alton L. Hanna, and May Senn.

At Halifax, N.S., the erection of a Science building for Dalhousie University is well advanced and it is hoped to have the building completed by September. The total estimated cost of the work is $150,000. The architect is A. R. Cobb, and the general contractors are Messrs. Falconer & McDonald, Halifax.

At Ottawa, foundation work has been completed on a store and apartment building estimated to cost $180,000, for Mr. Donald Fraser. The architects are Messrs. Horwood, Taylor & Horwood, 130 Sparks street, Ottawa. The contractors for the steel work are the Dominion Bridge Company. The building will be of solid brick construction.

At Quebec, operations are proceeding on the erection of a boarding school for the Good Shepherd Nuns. The building will be six storeys high, 137 ft. by 80 ft. in dimensions, and will cost $100,000. The architects are Messrs. Tanguay & Lebon, 20½ d'Aiguillon Street, and the general contractor is Mr. Ed. Belanger, 185 Ste. Marguerite Street, Quebec.

The Dominion Steel Company is carrying out a number of extensive orders at the present time, one of which is an important order for rails from the Canadian Northern Railway Company. The plant is working at maximum pressure and according to an announcement made a few days ago by an official of the firm, the works will be kept going night and day for the remainder of the year.

About $100,000 worth of buildings are being erected at Acadia, N.B., this year. A new three-storey building of brick construction, and somewhat larger than the building which was burned down some time ago, is in course of construction at the Acadia University. A library building is also being built together with a girls' dormitory. All three structures are expected to be completed this fall.

The city council of St. John, N.B., has passed a resolution favoring the provision of an incinerator for the city, the cost not to exceed $50,000. The commissioners of finance and of public works have been authorized to visit other cities where modern incinerators are installed, with a view to obtaining the necessary information as to the type of plant that would be most suitable for St. John.

At Fort William, Ont., the construction of a trunk sewer on Stanley avenue, in the west end of the city, which has been under way during the past two years, is being pushed forward rapidly. This sewer is being laid about 30 feet below the surface of the ground and it is reported that nearly sixteen lineal feet is being constructed daily. It is anticipated that with favorable conditions the contract will be completed this autumn.

At Fort William, Ont., tenders will be called in a few days in connection with the construction on the city hall square of a new Registry Office, plans for which have already been prepared. It is the intention to start building before August and to complete the building before the end of the present year. A five-storey business block of reinforced concrete is to be built on Brodie street for Messrs. Cameron & Company at an estimated outlay of $76,000. Tenders are at present being called for the work.

A movement is on foot at Fredericton, N.B., to establish a plant for the manufacture of concrete blocks, bricks, etc. With a view to obtaining first-hand information concerning the most up-to-date plants, Mr. T. C. Burpee, President of Concrete Builders, Limited, visited the principal cities of Canada, including Montreal, Toronto, London, and Ottawa, recently. The company has already purchased new machinery and it is their aim to inaugurate a concrete-brick manufacturing plant at Gibson, N.B., which will compare favorably with similar plants in other parts of the Dominion.

Reports from Fort William regarding the demand for bricks are very encouraging. It is stated that many thousands of bricks are being manufactured daily by the different plants. The Alsipe Brick & Tile Company are stated to be working to capacity and producing 70,000 bricks a day; the Fort William Brick & Tile Company some 26,000, and the Superior Brick Company about 35,000. At the new plant of the Mount McKay Products, Limited, a good deal of activity is also being shown in the construction of new kilns, although brick-making for commercial purposes will not be under way for some time.

The Union Block on the south-west corner of Adelaide and Toronto streets, Toronto, will be demolished shortly to make room for the new Excelsior Life office building. The following is a partial list of tenants who are removing to new quarters: W. T. Stewart & Son, roofers, Stevenson Building, 110-112 Church street; Don Valley Brick Works, New Dominion Bank Building, corner King and Yonge streets; Designing & Draughting Company, architects, 54 Adelaide street east; D. C. Cotton, architect, 54 Adelaide street east; Williams & Cole, engineers, 54 Adelaide street east; C. P. Bond, architect, 28 Toronto street; Bowman & Connor, engineers, 16 King street west.

The American Hoist & Derrick Company have removed their Seattle office from 613 Western avenue to 1512 L. C. Smith Building. This office is in charge of Mr. F. R. Schoen.

WESTERN CANADA

At Lethbridge, Alta., the Anglican church congregation under the Rev. Murrel-Wrighte contemplate the erection of a church, hall and rectory at a cost of $150,000. Plans have been completed by the architects, Messrs. Clemesha & Portnall, of Regina.

Plans are being drawn for a new postal station and office building at Vancouver at an estimated cost of $250,000.

The city of Regina has included in its estimates the sum of $380,000 for the installation of a power plant and extensions to the electrical distribution system.

At Victoria, B.C., an astronomical observatory will be established in the near future at a cost of $200,000. The station will be equipped with a 72-in. reflecting telescope.

The oil boom which started in Alberta some time ago seems to have reached Saskatchewan, six companies, with an aggregate capital of $2,000,000, having been organized in that province lately.

Calgary, Alta., has under construction this year 150,000 square yards of asphaltic concrete pavement, about 3,000 square yards of stone block and approximately 800 square yards of vitrified brick.

For an addition to the Royal Alexandra Hospital at Edmonton, estimated to cost $120,000, the contract has been awarded to the Zenith Construction Company. The architect is Mr. R. W. Lines, of Edmonton.

The foundation stone was laid a few days ago at Winnipeg for the erection of a new school at a cost of $190,000. The building, which will be known as the King Edward School, is to contain twenty-four classrooms.

A substantial deposit of silica sand was discovered recently near Redcliffe, Alta. It is said to resist a temperature of 3,000 degrees and to possess properties which indicate its suitability for clay products, iron works, etc.

Red Deer, Alta., is to have a new post-office building at a cost of $110,000. Tenders for erection are now being received by the architects, Messrs. Sharman, Barnes & Gibbs, of Red Deer and Edmonton. Bids close July 15.

Certain alterations required in the plans have brought about a cessation of work on the post-office and customs house which are being erected by the Dominion Government at Three Rivers, Que., at a cost of $225,000.

Work on the big interior elevator for the Dominion Government, at Saskatoon, is being pushed forward rapidly, and a large army of men is engaged in its construction as it is the intention to have the elevator completed in time to handle the forthcoming crops.

The contract for the erection of an elevator with a storage capacity of 30,000 bushels for the Dominion Elevator Company, is reported to have been received by the Harper Construction Company, Winnipeg, to replace the elevator which was burned down recently.

At Port Coquitlam, B.C., work has started on the erection of a bridge over the Pitt River. The structure is being erected by the Department of Public Works at a cost of $300,000. The general contractors are Messrs. Armstrong, Morrison & Company, Limited, Vancouver.

Revised estimates for extensions to the waterworks at Regina, involving an outlay of $250,000, have been adopted by the council of that city. The work comprises reservoir, wells, meters and pipe lines. The superintendent of the Waterworks Department is Mr. J. M. MacKay.

The new steel bridge which is being constructed across the Saskatchewan River at 25th street, Saskatoon, is not expected to be in operation before the fall of 1915. Eighteen carloads of steel arrived last month for use on the new bridge, the construction of which will involve an expenditure of nearly half-a-million dollars.

At Winnipeg, tenders are about to be called for the erection of the Engineering Building of the University of Manitoba. The estimated cost is $250,000. The plans were prepared by Mr. V. W. Horwood, 261 Fort street. Messrs. Brown & Vallance, Montreal and Winnipeg, are the consulting architects.

In connection with the recent oil boom at Calgary, Alta., it is reported that a company intends drilling for oil and gas near Aldersyde, convenient to a well which is at present producing petroleum gas at a depth of only 280 feet, and that the company will drill a number of wells until a flow of 400 feet of gas is obtained. Condensers of the Bessemer type will be installed for the purpose of extracting the gasoline.

Announcement was made recently by Mr. W. H. Willson, Secretary of the Board of Trade, that there is a possibility of an eastern corporation locating a steam plant in Calgary, Alta., in the near future. It is predicted that the directors of the company intend after they have got their plant under way to experiment along the line of non-expansion steam. The local board of trade has been active in the matter with the result that a possible site for the location of the plant has been purchased by a representative of the company.

The Vancouver and District Joint Sewerage Board will receive tenders until July 18 for the construction of trunk sewer mains at an estimated cost of about $350,000. This contract has reference to extensions of the China Creek sewer to Central Park with tributary mains to Gladstone, Collingwood and Earls Road districts, and a separate trunk sewer to Trout Lake. Another contract, which is under way and will probably be completed next November at a cost of $250,000, relates to the China Creek and Canoe Creek mains and a portion of South Vancouver.

The Dominion Government has selected a site for the erection of a transfer elevator to be built in Vancouver at an estimated cost of from $750,000 to $1,000,000. Plans will be prepared without delay and tenders will be invited for the structure in a month or so. The elevator is to be built on a site situated on the government dock in Vancouver Harbor. It will furnish facilities much needed by the Pacific coast but claimed to be especially valuable in view of the opening of the Panama Canal, besides completing a chain, extending from east to west, of interior storage elevators now being built or under contract in Calgary, Saskatoon, Moose Jaw and Fort William.

The feasibility of encouraging the establishment of an iron and steel industry at Vancouver, B.C., was reported upon recently by the mining committee of Vancouver board of trade. There is still an ample supply of raw material in the form of magnetite ore at Texada, Nelson, and other islands, as well as on the east and west coast of Vancouver Island. Other kinds of ore are also reported to be present in abundance in different parts of Vancouver Island but there are no known deposits of iron ore of commercial value on the Pacific coast south of British Columbia.

At Victoria, B.C., a 7,000-ton floating dry dock owned by the Seattle Construction & Dry Dock Company has been leased to Messrs. Grant, Smith & Company, contractors, for use in connection with the construction of a breakwater in the outer harbor. Fifty-four caissons will be built, two of them being constructed simultaneously upon the dry dock. The weight of each will be about 3,500 lbs. As the concrete piers are being built the dry dock will be allowed to sink as the construction of the piers advances. Upon completion they will be held in suspension by cranes during their removal, after which they will be fixed in place. The water level is regulated by means of watertight compartments in the bottom and sides of the dry dock.

Information received at this office reports that building operations at Saskatoon, Sask., are quite active just now. A number of important buildings are in course of construction and there is a marked increase in the permits taken out for residences. A large store and office block, a cold storage warehouse, and a distributing warehouse (for the Prairie City Oil Company) figure prominently among the business permits taken out in June. In addition, the Canadian Townsite Properties Limited, have commenced the excavation of a basement upon which it is their intention to erect a business block. A new sedimentation basin is being constructed by the city council near the filtration plant, while the construction of an additional students' residence at the University of Saskatchewan is well under way. It is estimated that about $300,000 will be spent in additions to the University during the present year.

Coming Events

The annual meeting of the Ottawa Branch of the Canadian Society of Civil Engineers will be held in the Federal Capital on the first Wednesday in October.

The Royal Architectural Institute of Canada will hold its seventh annual meeting at Quebec, September 21-22. The Hon. Secretary is Mr. Alcide Chausse, 5 Beaver Hall Square, Montreal.

The American Road Builders' Association will hold their annual convention, good roads congress and exhibition of machinery and materials in Chicago, September 14-18 next. The Secretary is Mr. E. L. Powers, 150 Nassau Street, New York.

The annual convention of the Union of Canadian Municipalities is to be held at Sherbrooke, Que., from August 3-5 next. The Hon. Secretary is Mr. W. D. Lighthall, of Westmount, Que., and the Assistant Secretary is Mr. G. S. Wilson, 402 Coristine Building, Montreal.

Unusual Conditions at Main Pumping Station, Toronto

Unusual conditions were disclosed upon an examination at the city's pumping station of the centrifugal pumps which had been reported inefficient by the Works Commissioner. It was found that the revolving wheel of the pump was choked with wood and that a considerable quantity of sand completed the trouble. The charge in reference to the pumps, so far from being sustained, has completely vindicated them on the score of construction, capacity and efficiency. In 1912 an official test was made by the civic officials, the Hydro people testing the electrical end, when it was found that the capacity and efficiency were above the guarantees. The pumps were installed by the Jens Orten Boving Company, of London, Eng., the contract dating back to 1909.

The Missisquoi-Lautz Corporation, Limited, Philipsburg, Que., have issued a neat folder to architects dealing with Canadian marbles. The Missisquoi marbles are claimed to be the standard marble for government, bank and office buildings, lending themselves harmoniously as they do to any color scheme. Missisquoi marble was used throughout in the interior decoration and construction of the Alberta Parliament Buildings at Edmonton, and in this connection special reference was made recently to the excellent effect by Sir Gilbert Parker, a well-known member of the Imperial House of Commons. The approach is dignified, forceful and strong. It has individuality which reflects the character of the province and the people of Alberta.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Edmonton, Alta.
Work is to start on the construction of 100,000 square yards of paving on various streets for the city council, the general contractor for which is the City Construction Dept., A. J. Latornell, Engineer.

Fergus, Ont.
Tenders will be received by Wm. Griffin, Supt. Wellington County House of Industry and Refuge, until July 9th, for the erection of modern cement silo, 28 ft. x 12 ft., with roof and ventilator, air tight doors. Contractor to furnish plans and specifications.

Hanover, Ont.
The necessary by-law having been passed, tenders for extensions to the waterworks system will be received by the town clerk, John Taylor, until July 21st. The estimated cost is $15,000.

Herbert, Sask.
The Rural Municipality of Waldeck is having a by-law submitted for roads improvement at an estimated cost of $10,000. J. J. H. Sawatzski is the Sec.-Treas.

Halifax, N.S.
The city council contemplates the construction of 1 mile or more bitulithic or sheet asphalt pavements on Spring Garden Rd., Argyle and Brunswick Sts., Cobourg Rd., etc. City clerk, L. Fred Monaghan, City Hall; engineer, F. W. W. Doane, City Hall.

Listowel, Ont.
The town council contemplates installing a new waterworks pump, additional mains and equipment.

The town council has the construction of sewer extensions in contemplation, and an engineer is to be appointed. Mr. Wm. Climie is the Mayor.

Montreal, Que.
The Board of Commrs. will call for new tenders in about 2 weeks for one 24,000,000 gal. pump. L. N. Senecal is the Secretary.

Moose Portage, Alta.
The Moose Portage Oil Co., 507 Tegler Block, Edmonton, are receiving tenders and prices for drilling a 3,000 ft. well.

Neepawa, Man.
The town council is contemplating the construction of a granolithic sidewalk on west side of Brown Ave. from Davidson St. S. to lane. Sec.-treas., J. W. Bradley.

The town council proposes to lay the following 8-inch sewers on 3rd Ave. from Hamilton St. to Main St.; on 4th Ave. from Hamilton St. to Main St.; and on 1st Ave. from Vivian southwards for a distance of 250 feet.

Ottawa, Ont.
Work is to start on the laying of asphalt pavement on St. Andrew at an estimated cost of $5,194; to be done by day labor.

Owen Sound, Ont.
The town council (board of works) has plans in progress for the construction of tile sewers. Chas. Gordon is the clerk.

The town council is having plans prepared for the construction of a number of new cement walks, curbs and gutters. Clerk, Chas. Gordon.

Regina, Sask.
The city council (Waterworks Dept.) has adopted revised estimates for waterworks extensions, including reservoir, wells, meters and pipe lines, at an estimated cost of $250,000.

The city council (Waterworks Dept.) has approved the expenditure of $16,890 for the completion of subway, pavement, sidewalk, curb and gutter on Broad St. Geo. Beach is the city clerk, and F. McArthur, engineer.

The city council (Works Dept.) has obtained revised estimates ($46,606) for the construction of filter bed at sewage disposal works. F. McArthur, Engineer.

The city council (Works Dept.) intend carrying out 40,440 square yards of street paving and 672 square yards of track paving this year, at a revised estimated cost of $146,906.

Red Deer, Alta.
The town council is to submit a bylaw in connection with a proposal to lay concrete sidewalks. Mayor, S. N. Carscallen; clerk, A. G. Stephenson; engineers, Seymour & Dawe.

Swift Current, Sask.
Tenders will be received by the town clerk, Geo. D. Arnott, until 5 p.m. July 14th, for the construction of 27,571 sq. ft. of 11 ft. 6 in., and 25,410 sq. ft. 5 ft. cement sidewalks with 6-in curbs. Plans and specifications are with the engineer, W. Curlee.

Sandwich Twp. E., Ont.
The contract has been awarded by the Twp. Council, Ford City, to Gouin & Desjardins, Tecumseh, Ont., for the construction of 7 miles concrete paving from Walkerville to Oldcastle, and some culverts at $51,000. Owen McKay, Walkerville, is the engineer.

St. Clet, Que.
Tenders will be received by the Sec.-Treas., Barnabe Bourbonnais, until 7 p.m. July 13th, for about 12½ miles of macadamizing for the municipal council. Plans, etc., are at the office of the Sec.-Treas.

St. John, N.B.
The city council will call tenders for the following items: Galvanized iron pipe for renewing the present water pipes in sheds No. 1, 2, 3, 4, 5 and 6. Sand Point: 800 ft. 2-in. galvanized iron pipe; 900 ft. 3-in. galvanized iron pipe; 150 ft. 4-in. galvanized iron pipe; 350 ft. 5-in. galvanized iron pipe; 700 ft. 6-in. galvanized iron pipe; 600 ft. 8-in. galvanized iron pipe; also 12 flanges for different sizes of pipe. Commr. Harbors, Ferries and Public Lands, Mr. Russell; Commr. Water and Sewerage, R. W. Wigmore.

Stettler, Alta.
Plans are in progress for contemplated extensions to waterworks by the town council. Mayor, N. B. McGillvray; clerk, L. C. Harry; engineer, J. Jamieson.

Taber, Alta.
The extension of the watermain by 6,900 feet is contemplated by the city council, of which Geo. C. Millar is the secretary-treasurer.

Tillsonburg, Ont.
The town council is contemplating the construction of macadam roads on John Pound Rd., Bidwell, King and Brock Sts. Mayor, W. B. Hogarth.

Tilbury, Ont.
The town council will probably purchase waterworks equipment in the near future. W. H. Hutton is the clerk.

Toronto, Ont.
The following contracts have been awarded by the Board of Control for sewer construction: Fussell, McReynolds Co., 1398 Gerrard St. E., Terauley St., $15,950 and Midway Scheme $18,500.

The Board of Control has re-awarded the appended contracts for laying concrete sidewalks: W. E. Ransom, Dineen Bldg., DeSavery Cres.; A. Johnson, 35 Burgess Ave., Norway Place; H. Mitchell, 464 Brock Ave., Aziel St.; Routly & Summers, 38 Benlamond Ave., Kew Beach Ave.; Grant Contracting Co., 50 Front St. E., Cortleigh Cres. and Dinnick Cres.; A. Gardner & Co., 52 Strange St., Lonsdale and Davenport; Standard Concrete Paving Co., 74 Moscow Ave., Riverdale Ave.; Riverdale Concrete Paving Co., 256 Jones Ave., Riverdale Ave.; Godson Contracting Co., Ltd., Manning Chambers, $15,641 asphalt pavement on Wellington street from Spadina to Portland; Construction & Paving Co. of Ontario, Ltd., Confederation Life Bldg., $40,251 asphalt pavement on Agnes, Sheridan, Hugo, Humberside and Dupont; Asphaltic Concrete Co. of Toronto, Ltd., 74 King St. E., $2,590, Sheridan.

Vancouver, B.C.
Tenders will be received until noon July 16th, by Geo. W. Phipps, Sec.-Treas., Vancouver, and District Joint Sewerage & Drainage Board, 514-18 Birks Bldg., until noon July 16th, for the

following works: Approximately 2,600 ft. 6 ft. 6 in. tunnel sewers; 800 ft. 4 ft. 3 in. tunnel sewer; 21,000 ft. concrete sewer in trench and 1,500 ft. vitrified pipe sewer in trench. Plans, etc., are at the office of the Board.

Victoria, B.C.
The city engineer, C. H. Rust, has prepared estimates for the construction of bitulithic paving on concrete base, estimated cost $81,000; also for heavy asphalt, estimated cost $86,000, on Oak Bay avenue.

Winnipeg, Man.
Tenders will be received by the board of control M. Peterson, secretary, until July 10th for the construction of transformer pockets, manholes and duct runs. Specification is at the office of the engineer, J. G. Glassco, 54 King St.

Yarmouth Centre, Ont.
The municipal council contemplates the laying of a number of cement walks this summer.

CONTRACTS AWARDED

Calgary, Alta.
The city council has awarded the contract for the supply of special connections and valves in connection with the installation of a 5-million gallon pump to the Canadian Allis-Chalmers Co., 11th Ave. and 4th St. W., at $1,587.

Dunnville, Ont.
The town council is constructing sewers and water mains for which the general contract has been given to Richard Hicks, Dunnville, for the supply of 4-in. tile, at 40 cents per ft.; 6-in. tile, at 47 cents per ft. Clerk, Jno. W. Holmes.

East Williams Twp., Ont.
The township council has awarded the contract for concrete work for bridges at $5 per yard for abutments and 25c per foot for flooring, to D. G. Moore, Nairn, Ont. Clerk, Wm. McCallum, Nairn P.O.

Eastview, Ont.
The town council has awarded N. Newland, 62 Brighton St., Ottawa, the general contract for the construction of concrete sidewalks. Patterson & Byrne, Sparks St., Ottawa, are the engineers.

Harwich Twp., Ont.
The contract for the construction of five new concrete bridges and repairs to a number of others has been awarded by the township council to Wesley Tuck, Blenheim P.O.

Kildonan, Man.
The Rural Municipality of West Kildonan has awarded the contract for the construction of a 6-ft. concrete sidewalk on Main St. to the Dominion Construction Co., 290 Selkirk Ave., Winnipeg.

London, Ont.
The city council has given the contract for sanitary sewers on Wortley Rd. and Emery St. to Mackay, Mackay & Webster, Bank of Hamilton Bldg., Hamilton. Wm. N. Ashplant is the engineer.

Ottawa, Ont.
The city council has awarded the general contract for the construction of asphalt pavements on various streets to the Ottawa Constr. Co., Central Chambers, at $95,000 odd.

Port Stanley, Ont.
The Producers Fish Co., Ltd., has awarded the general contract for the construction of a $7,000 fertilizer plant. to L. H. McIntyre. Building will be white brick construction, shingle roofing, coal chutes are also to be constructed. General manager, F. R. Robbins.

St. Catharines, Ont.
The city council has awarded the following contracts for pavements: Warren Bituminous Paving Co. of Ont., Ltd., 103 Bay St., Toronto, 15,000 sq. yds. bitulithic, at $40,000; Foley & Gleeson, Central Chambers, Ottawa, 20,000 sq. yds., asphaltic concrete, at $50,000.

Ste. Anne, Que.
The town council has awarded the contract for the construction of an $8,000 sewer on Chicoutimi, to Jno. Giard, Chicoutimi.

The contract has been awarded by the town council for the construction of a $15,000 aqueduct on Chicoutimi, to Jno. Girard, Chicoutimi (labor only). J. A. Claveau, Chicoutimi, is the engineer.

Toronto, Ont.
Dominion Bridge Co., Ltd., Imperial Life Bldg., has been awarded the contract for the superstructure of a bridge on Strachan Ave. for the Toronto board of control.

Railroads, Bridges and Wharves

Colchester North Twp., Ont.
Essex County Council is contemplating the construction of a $4,000 bridge, 100 ft. x 20 ft., concrete and steel. M. P. Coyle, Sandwich, is the clerk.

Kincardine, Ont.
Tenders will be received by the Sec., R. C. Desrochers, Ottawa, until 4 p.m. July 14th, for dredging at Kincardine, Bruce Mines, Port Hope or Little Detroit, for the Dom. Govt. Dept. Public Works. Plans and specifications are at the office of the Sec., Ottawa, and MacLean Daily Reports, Ltd., 220 King St. W., Toronto. Details follow: Kincardine, 25,000 cu. yds.; Bruce Mines, 45,000 cu. yds.; Port Hope, 17,580 cu. yds.; Little Detroit, 4,000 cu. yds. Work is to be completed Dec. 15th, 1914.

Listowel, Ont.
The Town Council has awarded the contract for alterations to fire hall to Geo. Fritz.

Mochelle, N.S.
Tenders will be received until July 31st by R. C. Desrochers, Secretary of the Public Works Dept., Ottawa, for the construction of a public wharf of solid stone-filled cribwork. The main portion is to be 520 feet long by 20 feet wide. Plans, etc., are with the district engineers at Halifax and Antigonish, N.S.

Mornington Twp., Ont.
Tenders will be received by the warden, S. E. Smith, Listowel, and Mr. Geo. Dickson, Rothsay, P. O., until noon July 11th, for the construction of (1) abutments and wing walls for steel beam span to be built on the line between Perth and Wellington; (2) steel beam span of 24 ft. clear; (3) for bridge approaches.

Paisley, Ont.
The sub-contract for masonry in connection with the building of a $24,000 school for the public school board has been let to Geo. Fritz, Listowel. General contractor, H. Ankerman, Harriston. Architect, J. S. Russell, 21 Downie Street, Stratford. Secretary, W. R. Barnett. Heating, plumbing and heating are not yet let.

Port Coquitlam, B.C.
The following contracts have been let by the Prov. Govt. Dept. of Public Works, in connection with the construction of a $300,000 bridge across the Pitt River. General contractors, Armstrong, Morrison & Co., Ltd., 543 Granville St., Vancouver; piling, J. W. Grant, Port Hammond; lumber, Burlett Lumber Co., Sapperton.

Port Dover, Ont.
New plans are to be prepared for the construction of an entrance to railway line into Port Dover, for the Lake Erie & Northern Rly. Co. Rails to be for steam traffic instead of electric as first planned. Mr. Kelliett, Brantford, is the engineer.

Regina, Sask.
The City Council (Works Dept.) has set aside $35,000 for the construction of an overhead bridge across the C. P. R. tracks, Hamilton Street. Clerk, Geo. Beach; Engineer, F. McArthur.

The city council (Street Railway Department) has included in its estimates $54,262 for extensions to the street railway system. City clerk, Geo. Beach.

Windsor, N.S.
Tenders will be received by R. C. Desrochers, Ottawa, Secretary Dominion Government, Department of Public Works, until 4 p.m., July 31st, for harbor improvements, including the construction of extension to Government wharf 154 ft. long by 25 ft. wide. Plans, etc., are at the office of the District Engineer, at Halifax, N.S., Antigonish, N.S., Postmaster, Windsor, and at Department, Ottawa. Specification is at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Winnipeg, Man.
Grading will start on the Central Canada Railway Company's line from Winnipeg to Edmonton via Yorkton, Saskatoon and Battleford, the general contractor for which is J. D. McArthur, McArthur Bldg. No steel will be laid this year.

CONTRACTS AWARDED

King Twp., Ont.
MacDougall & Toole, of Midland, Ont., have secured the contract for the construction of a reinforced concrete bridge over Cold Creek.

Public Buildings, Churches, Schools, etc.

Brandon, Man.
Plans are to be prepared and tenders to be called shortly for the construction of a school building on 23rd street for the school board. J. B. Beveridge, 1030 Victoria Ave., is the secretary.

Cayuga, Ont.
A by-law has been carried for the construction of a $16,000 school for the Public School Board. Architect, A. W. Peent, Clyde Block, King and Hughson Sts., Hamilton.

Durham, Ont.
Tenders will be received by R. C.

Desrochers, Ottawa, Sec. Dom. Govt. Dept. of Public Works, until 4 p.m. July 20th, in connection with the construction of a public building. Plans, etc., are at the offices of Messrs. Forster & Clark, architects, Owen Sound; Mr. Thos. Hastings, Clerk of Works; Postal Station "F," Yonge St., Toronto, Postmaster, Durham, and at Dept., Ottawa. Building will be 2-storeys and basement, stone and brick construction, concrete footings, stone foundation, cement finish, waterproofing, steel columns, marble and tile work; plumbing, concrete septic tank, skylights, galvanized iron, copper, felt and gravel roofing, cornices, metal lath, hard wall plastering, terrazzo and hardwood floors, 2 round, low base, hot water heating, furnaces (Taylor-Forbes or equal) twin-connected. Specifications at office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Embro, Ont.
O. J. Peacock, Lucan, Ont., contemplates the purchase of evaporator equipment.

Hamilton, Ont.
Tenders will be received by the architects, Stevens & Lee, 2 College St., Toronto, until about July 10th in connection with addition to Hospital on John St. S., at an estimated cost of $40,000. Owners, R. C. Corporation, Right Rev. T. J. Dowling, 354 West King St. Three storeys and basement, reinforced concrete and brick construction.

Harrow, Ont.
The school board is about to construct a $5,000 school building, for which plans are in course of preparation, by J. C. Pennington, LaBelle Bldg., Windsor, architect. Secretary, A. Agla, Harrow.

Isle Bizard, Que.
Tenders will be received by the Parish Priest about July 15th in connection with the carrying out of $5,000 alterations to Presbytery near Beaconsfield. L. J. Bigonnesse, 92 Notre Dame St. E., Montreal, is the architect.

Kamloops, B.C.
Tenders will be received by R. C. Desrochers, Ottawa, Sec. Dom. Govt. Dept. Public Works, until 4 p.m. July 24th, for the construction of a drill hall on Columbia St. and 6th Ave. Plans, specifications, etc., are at the office of Mr. Wm. Henderson, resident architect, Victoria, Caretaker Public Bldg., Kamloops, and at Dept., Ottawa. Specification is also at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto. Building will be 2-storeys and basement, brick construction.

London, Ont.
Plans are in progress for the erection of a parsonage on Dundas St., at an estimated cost of $7,000, for Dundas St. Centre Church. McBride & Gilbert, Dundas and Richmond Sts., are the architects.

Lucan, Ont.
The purchase of a quantity of elevator equipment is contemplated by Wm. Ward.

Merritt, B.C.
Tenders will be received by R. C. Desrochers, Ottawa, Sec. Dom. Govt. Dept. Public Works, until 4 p.m. July 28th. Plans, specifications, etc., are at the office of Mr. Wm. Henderson, resident architect, Victoria; Post Office, Merritt, and at the above Dept., Ottawa, in connection with the construction of public building for the government. Specification is at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto. The building will be 2-storeys and basement, concrete footings, damp proofing, stone and brick construction, pressed brick facing.

Montreal, Que.
The Lumber & Constr. Co., Ville St. Pierre, general contractors are taking tenders on all trades but carpentry, in connection with a $25,000 terra cotta and brick construction school on Notre Dame de Grace (Sherbrooke W.) for the School for the Blind. Architects, Wright & Son, 204 St. James St.

Regina, Sask.
Revised estimates totalling $111,084 have been prepared by the city council (Hospital Board) for the completion and equipment of hospital and equipment for new wing. N. R. Darrach, Western Trust Bldg., is the architect.

The city council has postponed the erection of a $25,000 fire hall.

The Hospital Board is unable to proceed with the erection of a $75,000 nurses' home, owing to lack of funds.

Prince Rupert, B.C.
Tenders will be received by R. C. Desrochers, Ottawa, Sec. Dom. Govt. Dept. of Public Works, until 4 p.m. July 13th, in connection with the construction of a $100,000 post office. Plans, etc., are at the office of G. B. Hull, Dis. Engr., Prince Rupert; Wm. Henderson, Res. Arch., Victoria, and at Dept., Ottawa. Specification is at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto. The building will be 4-storeys and basement, stone facing (all stone and granite to be Canadian), reinforced concrete, terra cotta and brick veneer construction.

Three Rivers, Que.
The Dom. Govt. Dept. of Public Works has suspended operations on the construction of a $225,000 post office and customs house pending the alteration of plans.

Toronto, Ont.
The Ebsary Fireproofing Co., 447 Confederation Life Bldg., has been given the contract for a $15,000 addition to brewery on Simcoe street for Cosgrave Brewing Co., 284 Simcoe street. Mr. Kirkpatrick, engineer, will superintend.

Plans have been prepared and tenders will be called shortly in connection with the contemplated addition of 4 rooms, to a school at Bedford Park for the Board of Education. Sec.-Treas., W. C. Wilkinson.

Tenders will be called shortly for the addition of 8 rooms to Davisville Ave. school. W. C. Wilkinson is the Sec.-Treas.

The Board of Education contemplates calling for tenders shortly for the addition of 9 rooms to school on Withrow avenue.

Unity, Sask.
Tenders will be received by the architects, Storey & Van Egmond, McCallum Hill Bldg., Regina, until July 11th, for a $9,000 school to be erected for the School Board.

Woodstock, Ont.
The city council has postponed until the fall the contemplated construction of a city hall at an estimated cost of $75,000. Sketches have been prepared by the architects, McBride & Farncomb, Dundas and Richmond streets, London.

Welland, Ont.
Tenders on plumbing, metal work, electric, etc., are called by the general contractors, Ryan & Gardiner, in connection with the carrying out of alterations and additions to a registry office, at a cost of $20,000, for the county council.

Windsor, Ont.
A masonic temple is to be erected on McDougal at an estimated cost of $15,000, and sketches are being prepared by the architects, Leybourne & Whitney, Sandwich St. E. Com., Isaac Nolan, 259 McDougal; Geo. Smith, 153 Wyandotte street.

Winnipeg, Man.
The Chapman School Dist. Board have decided to postpone until next year the contemplated construction of a $12,000 school building.

Yorkton, Sask.
The Minister of Public Works, Hon. A. P. McNab, Parliament Bldgs., Regina, will receive tenders until July 10, in connection with an extension to land titles office at an estimated cost of $10,000. Plans and specifications are at the Dept. of Public Works, Regina. Building will be 2-storeys, 31 x 29, stone, brick, reinforced concrete and fireproof construction.

CONTRACTS AWARDED

Edmonton, Alta.
The contract for additions to Royal Alexandra Hospital, at an estimated outlay of $120,000, has been awarded to Zenith Constr. Co., Agency Bldg. Architect, R. W. Lines, Canada Permanent Bldg. Building will be 3-storeys, brick construction.

Ft. William, Ont.
The Board of Education has awarded the contract for a heating plant for Drew St. school to Varlow Foundries Ltd., at $9,650. Seaman & Penniman, Rm. 17, Graham and Horne Block, have got the general contract for alterations and additions at $67,034.

Melville, Sask.
The Separate School Dist. has awarded the general contract for the erection of a $17,909 school to R. Westbrook, Melville. Sec., M. Salmon, P. O. Box 392, Melville; architect, J. H. Rudy, 301 Alexandra Block, Edmonton.

Montreal, Que., Pt. aux Trembles
The R. C. School Commrs. have let the following contracts in connection with the erection of a school. General contractor, Alphonse Gratton, 142 5th Avenue, Mainonneuve; steel, Phoenix Bridge & Iron Works, 83 Colborne St. The architect is C. A. Reeves, 58 St. James St., Montreal.

Norwich, Ont.
The Dom. Govt. Dept. of Public Works has awarded the general contract for construction of a $24,000 post office and customs house to Nagle & Mills, Thames St., Ingersoll.

(Continued on page 79)

Tenders and For Sale Department

Sealed tenders addressed to the undersigned and endorsed "Tender for Telegraph Wire," will be received at this office until 4 p.m. on **Monday, the 27th of July, 1914**, for 270,000 lbs. of Galvanized Iron telegraph wire delivered at Montreal, Que., also 342,000 lbs. of same delivered at Vancouver, B.C., early dates of delivery desirable.

Specification and forms of tender can be obtained on application to the office of the General Superintendent of the Government Telegraph Service at the Department of Public Works, Ottawa.

Each tender for one or both of the above mentioned lots of wire must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 30, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63727. 27-28

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Durham, Ontario," will be received at this office until 4 p.m., on **Monday, July 20, 1914**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the offices of Messrs. Forster & Clark, Architects, Owen Sound, Ont.; Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont.; the Postmaster, Durham, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 27, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63746. 26-27

Tenders

Sealed tenders addressed to the Secretary of the Department of the Interior, Ottawa, Ont., and marked "Tenders for laying 20 inches water main, Banff," will be received up to noon **Monday, July 27th, 1914**, for the laying and jointing of about 13,000 lineal feet of 20 inches interior diameter lap welded steel pipe for a new water main for the Town of Banff, Alberta.

Specifications may be had from the Commissioner of Dominion Parks, Ottawa, Ontario. The Chief Superintendent of Dominion Parks, Edmonton, Alberta, The Superintendent Rocky Mountains Parks, Banff, Alberta.

The lowest or any tender not necessarily accepted.

The unauthorized insertion of this advertisement in any newspaper will not be paid for.

LYNDWODE PEREIRA,
Secretary.

Department of the Interior,
Ottawa, Ont.—63622 27

Sealed tenders addressed to the undersigned, and endorsed "Tender for Breakwater, Negropoint, St. John County, N.B.," will be recieved at this office until 4 p.m. on **Wednesday, August 26, 1914**, for the construction of an Exteneion to the Breakwater at Negropoint, St. John County, N.B.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, St. John, N.B.; Halifax, N.S.; Post Office, Quebec, P.Q.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at St. John, N.B.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $50, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 30, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63273. 27-28

Tender for Coal and Ash Handling Apparatus

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, August 18th, 1914**, for the installation of coal and ash handling apparatus at the main pumping station.

Specification and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendiring as prescribed by City By-law must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, June 30th, 1914. 27-28

Sealed tenders addressed to the undersigned, and endorsed "Tender for Submarine Cables," will be received at this office until 4 p.m., on **Monday, July 27th, 1914**, for 23 knots of single conductor submarine telegraph cable (107 lbs. copper and 150 lbs. gutta-percha per knot) with sheathing of 12 No. 8 s.w.g. Iron Wires, to be delivered at Halifax, N.S., within eight weeks after order if one is given. Also for 14 knots same as above on several reels for distribution to be delivered at Vancouver, B.C., earliest dates of delivery desirable.

Specification and forms of tender can be obtained on application to the office of the General Superintendent of the Government Telegraph Service at the Department of Public Works, Ottawa.

Each tender for one or both of the above mentioned lots of cable must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 30, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63725. 27-28

Tenders Wanted

The trustees will receive tenders for the enlargement and roofing of Church building, also construction of Sunday School building at corner of John and Devine streets, City of Sarnia. Plans, specifications and full information can be obtained at the office of R. W. Fawcett, Architect, Sarnia, Ont.

Tenders will be received up to 12 noon **Wednesday, July 22, 1914**, and must be accompanied by a marked cheque for 10 per cent. of contract price. Tenders open for contractors on July 15, 1914.

The right is reserved to reject any or all tenders. Address George Leach, Secretary Trustee Board, 176 Christina Street, Sarnia, Ont.

27

Proposals for Temporary Trestle

Office of the Chief Engineer

Toronto Terminals Railway Company

Toronto, July 2nd, 1914

Notice is hereby given that sealed proposals, marked "Proposals—Temporary Trestle," will be received at this office, No. 114 Dowling Avenue, until 5 o'clock, **August 15th, 1914**, for the construction of a temporary trestle, in accordance with plans and specifications on file at the above address.

The company reserves the right to reject any and all bids.

J. R. W. AMBROSE,
Chief Engineer.

27

Orillia Water, Light & Power Commission

Town of Orillia, Ontario

Waterworks Extensions

Notice to Contractors

Sealed tenders will be received by the Secretary of the Orillia Water, Light and Power Commission, Orillia, Ontario, for the following works:—

Until 9 a.m. Monday, July 27th, 1914.

Contract "A"—Laying water mains.
Contract "B"1—Constructing reinforced concrete coagulating tank and pump house foundation. and brick superstructure.
Contract "C"1—Furnishing cast iron water pipe and specials.
Contract "C"2—Furnishing steel water pipe and specials.
Contract "D"—Furnishing gate valves and hydrants.
Contract "K"—Laying of Intake pipe in Lake Couchiching.

Until 9 a.m. Monday, August 3rd, 1914.

Contract "E"—Furnishing and erection of motor driven turbine pumps and equipment.
Contract "F"—Furnishing and erection of "Diesel" oil engine and appurtenances.
Contract "G"—Furnishing and erection of Mechanical Pressure type filtration plant.

Tenders shall be sealed and plainly marked on the outside Tender "A" or Tender "B," etc., as the case may be. The Commission reserves the right to reject any or all tenders or to call for new tenders or to accept any tender that may be in the interests of the Town of Orillia.

Plans and specifications may be seen on and after July 6th, 1914, at the office of the Canadian Engineer, Toronto, and at the Commission office, Orillia, Ont.

E. LONG, Chairman.
W. K. GREENWOOD, B.A.Sc.,
Engineer.

25-28

Town of Pointe Claire

Tenders for Extension to Sewers and Water System

Sealed tenders will be received at the office of the Secretary-Treasurer, Pointe Claire, up till noon on **Friday, July 10th, 1914**, for approximately 1,740 feet of 9-in. Sewer and 6 in. Steel Water Mains for extensions to present system.

A copy of the plans and specifications may be seen at the Engineer's Office, Pointe Claire.

G. C. ANDERSON,
Resident Engineer.

27

TOWN OF HANOVER

Province of Ontario

Waterworks Extensions

Sealed tenders for waterworks extensions addressed to the Town Clerk will be received up to 2 p.m., **Tuesday, July 21st, 1914**, for:

A.—Supply and erection of 100,000 gallon Steel Water Tower.
B.—Cast iron piping and valves.
C.—Laying piping, valves and fittings.

Copies of specifications of requirements can be obtained from the Town Clerk.

C.H.WITTHUN, Mayor.
JOHN MILLS, Clerk.

27-28

Tenders for Dredging

Sealed tenders addressed to the undersigned, and endorsed "Tender for Dredging, Ontario," will be received until 4 p.m., **Tuesday, July 14, 1914**, for dredging required at Kincardine, Bruce Mines, Port Hope or Little Detroit, as the case may be.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signature of tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work.

The Dredges and other plant which are intended to be employed on this work shall have been duly registered in Canada at the time of filing of this tender with the Department, or shall have been built in Canada after the filing of the tender.

Contractors must be ready to begin work within thirty days after the date they have been notified of the acceptance of their tender.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for five per cent. (5 p.c.) of the contract price, but no cheque to be for less than fifteen hundred dollars, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 26, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63733.

26-27

Cathedral Tenders

Tenders are invited for a Roman Catholic Cathedral to be built in Edmonton South, Alta.

Plans and specifications can be obtained from the office of Roland W. Lines, Architect, Edmonton, on the deposit of $50, which will be returned to bona fide tenderers if the plans are returned in good order.

Tenders to be sent in not later than noon, 30th day of July, accompanied with a marked cheque for 5 per cent. of amount of tender.

27-28

Tenders Wanted

Sealed tenders will be received by the undersigned, by Mr. S. E. Smith, Warden of Perth County, Listowell; and Mr. George Dickson, Rothsay P. O. Ont., up to 12 o'clock on **Saturday, July 11th**, for the construction of the following:—

(1) Abutments and Wingwalls for steel beam span to be built on the line between Perth and Wellington, opposite Lot 5, Township of Mornington.

(2) Steel Beam Span 24 ft. clear, located as described above.

(3) Approaches for above bridge.

Tenders will be opened at the Queen's Hotel, Listowell, on Saturday, the 11th day of July at 1 p.m. A marked cheque amounting to 5 per cent. of the tender to accompany said tender.

Plans and specifications may be seen at the County Engineer's Office; at Mr. Geo. Dickson's and at Mr. S. E. Smith's.

JOHN ROGER,
County Engineer, Perth.
Mitchell, Ont.

26-27

For Sale

Oak Piles, 30/60 ft.
Pine and Hardwood Piles, 30/60 ft.
Oak timber cut to order.

THE BRADLEY COMPANY,
Hamilton, Ont.

25-26-27

FOR SALE, at Hamilton, Ont., one derrick scow about 45 x 80 ft., fitted with one yard Owen Bucket, Mead-Morrison three drum hoisting engine, separate swinger engine and eighty horsepower boiler. Also one scow about 22 x 78 ft. Apply JOHN W. DANFORTH COMPANY, 72 Ellicott Street, Buffalo, N.Y. 27

Position Wanted

Wanted by graduate Civil Engineer (1906), age 31, position as erection superintendent on steel erection, eight years' experience.

Open for engagement at once.

Box 50, Contract Record, Toronto. 27-28

Public Buildings, Churches, Schools, etc.

(Continued from page 77)

Regina, Sask.

Additional contracts have been awarded by the Gratton R. C. School Board in connection with the construction of a $26,000 school as follows: Steel, Regina Foundry Co., Ltd., 6th and Lorne; painting, Carl Molter, 1602 Victoria Ave.; heating, plumbing and electrical, Whiteford Bros., 2231 S. Railway St. Architect, J. E. Fortin, 210 Kerr Block. General contractors, mason, carpentry, roofing and plastering, Wilson & Wilson, Westmann Chambers.

Stratford, Ont.

The contract for electrical fittings in

connection with the additions to Hamlet School, Church Street, has been awarded by the Public School Board to W. Bennington, 110 Ontario Street, who has also secured the contract for similar work at the public school building in the Avon Ward.

Vegreville, Alta.
The contract has been awarded to Gillies & Coambs, Vegreville, for the construction of a $29,000 school for St. Martins R. C. School Dist. Sec.-Treas., Rev. J. Garvier.

Warner, Alta.
The School Board has let the general contract for a $35,000 school to Smith Bros. & Wilson, Lethbridge. F. Palmer, Dominion Bldg., Lethbridge, is the architect.

Business Buildings and Industrial Plants

Arnprior, Ont.
The architect, F. C. Sullivan, Castle Bldg., Queen St., Ottawa, has prepared plans for alterations and additions to hotel for John Cunningham.

Aylmer, Ont.
Seating (600) and equipment is required in connection with contemplated alterations to a moving picture theatre, for Jno. Reevely, Bingham Block.

East End, Sask.
An examination is being made of the clay beds near East End with a view to the installation of a sewer pipe factory for the American Sewer Pipe Co., Akron, Ohio, U.S.A.

Elmira, Ont.
Mr. Casper Stumpf contemplates installing an up-to-date dough mixer and sifter, to be run by electric motor.

Halifax, N.S.
Plans are to be prepared for the construction of a theatre on Gottingen St., for the Casino Co., Ltd. (Fred McManus), which has just been incorporated with a capital of $100,000. Architect, H. E. Gates, Dennis Bldg., Granville St.

Hamilton, Ont.
The National Paper Goods Co., 302 Cumberland Avenue, contemplate the building of a new plant or addition to present one. An architect has not yet been appointed.

Moose Jaw, Sask.
Moose Jaw Abattoir Company has secured a site for the erection of a $60,000 abattoir, 200 x 70, to be completed by July 1st, 1916.

Montreal, Que.
The architect, D. J. Spence, 46 Beaver Hall Hill, is now receiving tenders for the erection of a $35,000 garage and stables on Cedar Ave., for Lt.-Col. W. W. Burland, Pine Ave.

Plans are in progress and bids will be received shortly by the architects, Gordon & Aird, Stanley St., in connection with contemplated alterations and additions to bakery on St. Urbain St., for Jas. M. Aird, 165 St. Urbain St.

Ottawa, Ont.
The erection of a theatre on Queen street, with a seating capacity of 1,000 is contemplated by Ben. Stapleton, Mgr. Majestic Theatre, Sparks street.

J. A. Langelier, 310 Wellington St., contemplates the construction of a warehouse on Queen West.

Sherbrooke, Que.
Sherbrooke Constr. Co., St. Francis St., has got the contract for the construction of a machine shop on Randrill, for Sherbrooke Machinery Co., Ltd., Lewis and Randrill St. H. G. James, Whiting Block, is the architect.

Truro, N.S.
Funds are being raised for the erection of a $30,000 building for the Home for Delinquent Girls.

Tilbury, Ont.
The erection of a $10,000 business building, two storeys, red brick construction, stone and concrete foundation, is contemplated by M. Stewart, hardware merchant, and an architect is to be selected.

Victoria, B.C.
Plans are prepared in connection with the contemplated construction of six $250,000 stores on Fort and Government St., for Heisterman, Foreman & Co., 1210 Broad St. Architect, C. E. Watkins, Green Block.

Windsor, Ont.
The Windsor Hotel Company's project for the erection of a $350,000 hotel on Quellette and Park has been abandoned.

The city council has had plans drawn for the erection of a pavilion on the River front, 30 x 160, reinforced concrete and frame construction. J. C. Pennington, La Belle Bldg., is the architect and M. E. Brian, city engineer.

New tenders will be received by the architect, J. C. Pennington, LaBelle Bldg., until July 21st, for the construction of a $36,000 factory on Pitt St. E., for J. T. Wing & Co., 61 Sandwich St. E. Building will be 4-storeys, 100 x 135, steel and brick construction.

Winnipeg, Man.
The sub-contract for heating and plumbing in connection with the construction of 2 comfort stations on Fort and Garry, at a cost of $21,000, has been given to Bearisto Plumbing Co., 286 Fort street.

Winnipeg, Man., St. Vital
Plans are in progress and tenders will be called in a few days for the construction of a 3-storey, 200 x 75, engineering building at an estimated cost of $250,000, for the University of Manitoba. Minister of Public Works, Hon. W. H. Montague; Prov. Arch., W. Harwood, 261 Fort St., Winnipeg; Consulting engineers, Brown & Vallance, McArthur Bldg., Winnipeg.

CONTRACTS AWARDED

Camrose, Alta.
The contract for the erection of two stores on Main street, for A. Carruthers has been let to the local contracting firm of Burrows and Calver.

Cornwall, Ont.
The following contracts have been awarded in connection with the alterations to the Hotel Dieu. Masonry, T. C. James, 140 Flora St., Ottawa; steel, Dom. Bridge Co., Lachine, Que.

London, Ont.
The following contracts have been awarded on the Bank of Toronto alterations. Carpentry, S. Willis, Talbot and Oxford streets; electrical work, Commercial Elec. Co., Richmond street; painting, W. Page & Sons, 712 Princess avenue.

Montreal, Que.
Reid, McGregor & Reid, Drummond Bldg., have secured the general contract for the erection on Beaumont St., of a $32,000 four-storey factory of brick construction, for Martin Senour Paint Co., 655 Drolet St. W. B. McLean, 204 St. James St., is the architect.

Peterboro, Ont.
The McDonald Estate Lumber Co., have suffered a loss of $3,500 through the destruction by fire of their shingle mill.

Sherbrooke, Que.
The contract for the erection of a shoe factory has been awarded to Sherbrooke Constr. Co., St. Francis St. Owner, J. H. Hamilton, Levis, Que.; architect, T. R. Peacock, St. Peter St., Que.

Residences

Montreal, Que.
Anglins, Ltd., who have the contract for alterations to the residence of Miss Foley, on University street, are taking tenders for stone work, steel work, and roofing.

The following permits for residences have been issued from the office of the Building Inspector: 6 flats, $12,000 (St. Hubert), Mendoza Laglon, 401 Power Bldg.; 6 flats, $7,000 (DeGaspe Ave.), Z. Berthiaume, 694 Alma Ave.; 6 flats, $7,000 (280 Colonial), G. Bail, 102 Stadacona; 8 flats, $10,00 (Cote St. Paul Rd.), Mr. J. Aumont, 2710 Notre Dame W.; 2 flats, $10,000 (Wilson Ave.), R. Ryan, 713 Atwater Ave.

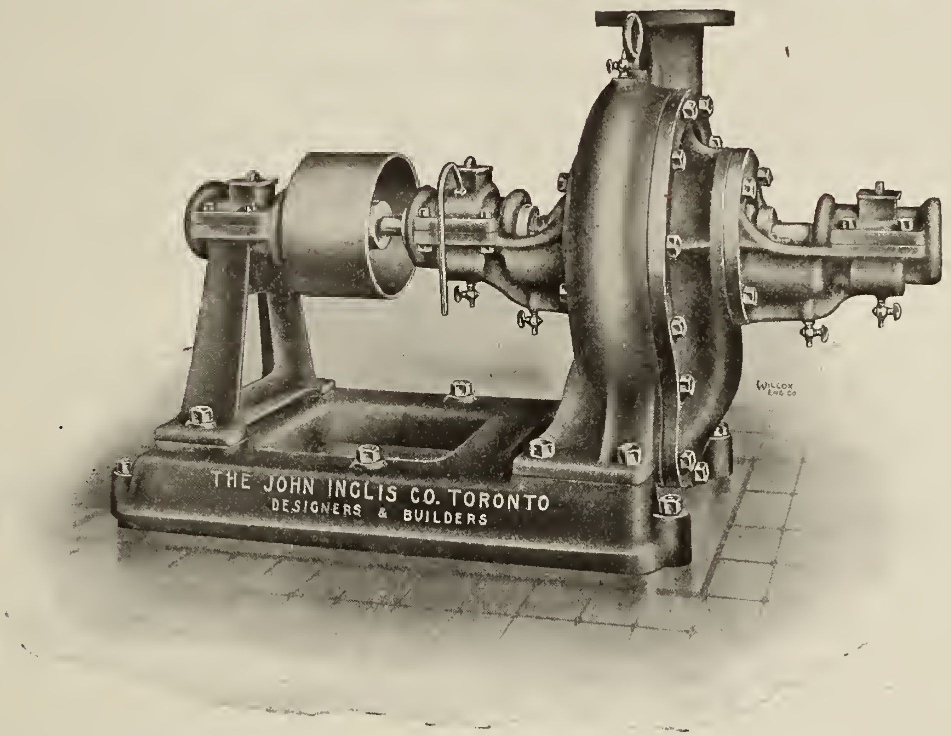
Montreal, Que. (Notre Dame de Grace)
The general contractor, D. Scott & Co., 155 Vendome Ave., is taking prices for the plastering work on his two $30,000 residences.

Foundations are in and the architect, L. J. Bigonnesse, 92 Notre Dame East, will call for tenders about July 15th for plastering, painting, heating and plumbing in connection with the construction of a $10,000 residence on Montclair.

Montreal, Que. (Westmount)
The following contracts have been declared in connection with the construction of a residence on Bruce & Dorchester, for Mr. Archibald, 314 Dorchester W. Mason, Jas. Young, care architect; carpentry, D. M. Long, Windsor street; roofing, Douglas Bros., 19 St. Maurice; plastering, McNulty Bros., 182 Mountain; painting, Alex. Craig, 41 Jurors Street; heating and plumbing not let; electrical, Sayer Electrical Co., Bleury street; stone and brick construction. Architects, Saxe & Archibald, 314 Dorchester St. W.

Ottawa, Ont.
Plans are prepared for the construction of $45,000 apartments on Third Ave., for Geo. Rupert, 39 5th Ave. The structure will be stone foundation, solid brick construction, felt and gravel roof-

PUMPS



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ing. Richards & Abra, Booth Bldg., Sparks St., are the architects.

Plans are drawn for addition to apartments, on O'Connor, at an estimated cost of $7,500, by David Epstein, 155 Laurier. W. G. Davis, 5 Spruce St., is the architect.

The construction of a $8,000 residence on Goulbourne, is contemplated by S. J. Hunt, 170 Arlington.

The erection of a $6,000 residence on Powell is contemplated by H. L. Morrison, 15 Ossington.

South London, Ont.

Plans are in progress and the architects, Watt & Blackwell, Bank of Toronto, will receive tenders for the construction of a $7,000 residence for J. B. Kerrigan, 234 Central Ave.

Toronto, Ont.

Permits have been issued for the building of one $5,000 residence on Scarboro Road for W. J. McWaters, 28 Kingswood Road, and one pair $4,000 residences on Woodville Ave., for Mrs. M. Mackey, 5 Fern Ave.

Plans are drawn in connection with the construction on Alberta Ave. of one pair $6,000 residences, for Scott & Scott, 45 Westmoreland avenue.

A permit has been issued for the construction of one pair $5,000 residences on Birch Ave., for A. J. Cooper, 37 McLean Ave.

Tenders are invited by Shaw Bros., 204 Beverley St., on plastering, painting, plumbing and electric, in connection with the construction of a $5,000 detached residence on 14 Highview Cres.

Tenders are invited on masonry, plastering, painting, plumbing and electric lighting in connection with the erection of one pair $6,000 residences on Oakwood Ave., near Rosemount. Owner, general contractor and carpenter, Fred. Brown, 1423 Dundas.

Plans have been drawn for the construction of 2 pair residences, at an estimated cost of $10,000 on Ellsworth Ave. W. of Christie. E. C. Elliott, 29 N. Markham St., is the owner and general contractor. Owner buys material.

Winnipeg, Man.

A permit has been issued in connection with the projected construction of a $10,000 residence on Montrose St., for W. P. Wallace, Ltd., 6 Lincoln Apts., who is also the architect and general contractor. The building will be 2½-storeys, brick construction, stone foundation, shingle roofing.

A permit has been issued in connection with the contemplated erection of a $6,000 residence on Church Ave., for A. Cohen, 489 Alfred Ave., owner, architect and general contractor.

A permit has been issued for the construction of a $10,000 residence on Oxford St. Owner, architect and general contractor, W. E. Toshack, Confederation Life Bldg.

The construction of a $55,000 apartment block on Young St., is contemplated. J. E. Wilson, 258½ Portage Ave., is the owner, architect and general contractor. The building will be pressed and common brick construction, stone foundation, felt and gravel roofing.

Windsor, Ont.

The projected construction of a $16,000 apartment has been postponed, but the owner, M. D. Armaly, expects to proceed with the work this fall. Architect, G. Jacques & Co., Boug Block.

CONTRACTS AWARDED

London, Ont.

The contract has been awarded to E. Foxworthy, 464 Pall Mall, for the construction of 2 residences on Central Ave., at a cost of $10,000, for E. Ryan, 423 Dufferin. Architect, Mr. Carruthers, Richmond and Carling Sts.

Montreal, Que.

The contract for addition and alterations to Windsor St. Hotel, at a cost of $15,000, has been awarded to J. Gilletz, 1206 St. Urbain St. Architect, Daniel J. Crighton, Jacobs Bldg., St. Catherine W.

The general contract has been awarded to Anglins Ltd., 65 Victoria St., for alterations to a residence at an estimated cost of $6,000 for Miss Ella Foley. Gordon & Aird, Stanley St., are the architects.

Ottawa, Ont.

The general contract has been awarded to H. D. McCormack, 53 Queen, for alterations to an apartment house on Nepean, at an estimated cost of $17,000 for L. Jones Estate. Architect, C. J. Burritt, Booth Bldg., Sparks St. Building will be stone foundation, brick veneer construction, felt and gravel roofing.

The contract has been awarded to A. D. Hudon. Clarkestown, Ont., for the construction of a $5,000 residence on Water St., for Prersi Junian.

The contract for alterations to apartments on Rideau St., at an estimated outlay of about $14,000, for Frank Low, 509 Rideau St., has been awarded to Ferguson & Lambert, c/o Owner. C. J. Burritt, Booth Bldg., Sparks St., is the architect.

The general contract has been awarded to R. A. Kemp, 149 1st Ave., for the construction of $22,000 apartments on Carling Ave., for Dr. H. C. Church, 116 Carling.

Regina, Sask.

The contract has been awarded to J. C. Meade, Merchants Bank Bldg., for a $5,000 residence on Princess St., for Theo. Brockmann.

G. L. L. Lownsborough, 209 Kerr Block, has got the contract for the erection of a $7,500 residence at Lakeview, for Professor C. G. Walker, c/o Regina College. Architects, Tripp & Rowley, Canada Life Bldg.

Toronto, Ont.

The contract for the erection of 3 pair residences, at an estimated cost of $9,000, on Norwood Rd., for Geo. Marshall, 310 Queen St. E., has been awarded to general contractor, H. Pickering, 530 Rhodes Ave., who buys material and sublets labor.

Power Plants, Electricity and Telephones

London, Ont.

The Hydro-Electric Commsn. is contemplating the purchase of electrical equipment including new machinery, transformers and generators for new power station. H. J. Glaubitz, City Hall, is the general manager.

Ottawa, Ont.

Tenders will be received by R. C. Desrochers, Ottawa, Sec. Dom. Govt. Dept. of Public Works, until 4 p.m. July 13th, for a heating system and materials for Eastern Block. Specifications and list at offices of R. L. Deschamps, Overseer, Post Office, Montreal; Thos. Hastings, Clerk of Works; Postal Station "F," Yonge St., Toronto, and at above Dept., Ottawa.

Tenders will be received by R. C. Desrochers, Ottawa, Sec. Dom. Govt. Dept. of Public Works, until 4 p.m. July 27th, for 270,000 lbs. galvanized iron telegraph wire, delivered at Montreal, Que.; also 342,000 lbs. of same delivered at Vancouver, B.C. Specifications, etc., are at the office of the Gen. Supt. of Govt. Telegraph Service, Dept. of Public Works, Ottawa.

Tenders will be received by R. C. Desrochers, Ottawa, Sec. Dom. Govt. Dept. of Public Works, until 4 p.m. July 27th, for the supply of 23 knots single conductor submarine telegraph cable, to be delivered at Halifax, N.S.; also for 14 knots same as above on several reels for distribution, to be delivered at Vancouver, B.C. Specifications, etc., can be seen at the office of the Gen. Supt. of Govt. Telegraph Service, Dept. of Public Works, Ottawa.

Regina, Sask.

The city council (light and power department) has included $380,000 in the estimates for the purpose of constructing a power plant and extensions to Elec. Distribution System.

Strathroy, Ont.

The installation of electrical sewing machines, irons and other equipment is contemplated by Newton & Freele, tailors.

Toronto, Ont.

The contract has been awarded by the board of control to A. Custodis Chimney Construction Co. Confederation Life Bldg., for the construction of chimneys at the main pumping station, $5,300 and at high level station, $4,765.

The Canada Last Co., 5 VanHorne Street, require shaving machines, saw tables, boring machines and lathes for their new factory. Tenders will be received by the Manager, Mr. J. C. Iriedale.

Windsor, Ont.

Menard Commercial Car Co., Windsor, has been awarded the contract for two motor trucks, combination chemical and hose wagons at $3,300 each, for the city council (fire department).

Winnipeg, Man.

The board of control will receive tenders until July 14th for the supply of ornamental iron lamps and trolley poles. Specification is with the engineer, J. G. Glassco, 54 King Street.

West Lorne, Ont.

The West Lorne Motors Co. (Manager, H. A. Carmichael) contemplates the purchase of equipment for the manufacture of autos and motor fire engines.

Miscellaneous

Calgary, Alta.

The following oil companies have been incorporated: Nochren Mannix Petroleum Co., Ltd., 112 Jasper Ave. E. Manager, J. P. Hogan; Millar-

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ville Oils Limited, care The Great West Finance Corporation, 216 8th Ave. W., Calgary. To drill for oil. Sharpe & Irvine Syndicate Ltd., 507 New Herold Bldg., Calgary. To drill for oil. Planet Oil & Gas Co., capital $500,000; Prairie Diamond Oil & Gas Co., capital $400,000; Blood Reserve Oil Co., capital $400,000; Claresholm, Alta., Claresholm Oil Co., Ltd., capital $500,000.

Esquimalt, B.C.

The municipal council is considering the question of expending between $6,000 and $8,000 on the provision of fire equipment. Clerk. E. A. Ellis.

Lucknow, Ont.

Machinery is required for the manufacture of wheelbarrows, sleighs, churns, etc., for the Bag Holder & Machine Co.

New Companies

The Alberta General Oils Co., president, P. M. Schubert, 224 Namayo Ave., Edmonton, manager, W. G. Fraser, 512 Sutherland street, capital $500,000. Capital City Oils, president, F. W. Pearce, 7th Ave. N.; vice-president, A. E. May, 258 MacKay Ave., capital $1,000,000. Spartan Oils Ltd.. capital $300,000. Universal Oil Fields Ltd., capital $650,000. Worswick Oil & Gas Co., capital $500,000. Blindman Valley Oil Co., Ltd., capital $500,000.

The Dominion Ship Building & Dry Dock Company, Limited, has been incorporated with a capital of $5,000,000, with head office at Vancouver, B.C., as ship builders, etc., and to carry on the business of civil, marine and general engineering.

The Belmont Canadian Mines, Limited, has been incorporated with head office at Vancouver, B.C., to engage in mining of all kinds and to carry on the business of a mining, smelting, milling and refining company.

The Omaneca Gold Dredging Company, Limited, has been incorporated with headquarters at Vancouver. The capital of the company is $100,000. The Curnshewn Iron Mines, Limited, has also been incorporated with a capital of $100,000. The head office is located at Victoria, B.C. The British Columbia Water Works Supplies, Limited, is incorporated with a capital of $25,000, with head office at Vancouver. The company will carry on business as general contractors.

The Amalgamated Dry Dock & Engineering Company of British Columbia, Limited, has been incorporated with a capital of $250,000, to construct dry docks and carry on the business of mechanical engineers, etc. The company's head office is at Victoria, B.C.

The Orpen Conduit Company, Limited, has been incorporated with a capital of $40,000, with head office at Toronto. The provisional directors are J. A. Kent, L. C. Jarvis, and J. D. Scott, of Toronto.

The J. M. Diver, Sons & Company, Limited, has been incorporated with a capital of $100,000, with head office at Sarnia, Ont., to carry on business as lumber merchants. The provisional directors are J. M. Diver, G. B. Diver, and T. S. Diver, all of Sarnia, Ont.

The Hall Engineering Works, Limited, has been incorporated with a capital of $200,000, with head office at Montreal. The provisional directors are T. Hall, of Montreal West, Que.; F. H. Fox, R. B. Proctor, and W. F. Fletcher, of Montreal.

Eastbourne Land, Limited, has been incorporated with a capital of $250,000, with head office at Montreal, to carry on business as a general land and building company. The provisional directors are. T. Rinfret, K.C., J. E. Billette, A. R. W. Plimsoll and R. Brodeur, all of Montreal.

Pneumatic Concrete Placing Company of Canada, Limited, has been incorporated, with a capital of $50,000, with head office at Montreal. The provisional directors are A. Wainwright, K.C., M. Alexander, and D. Burley-Smith, all of Montreal.

Prince Rupert Lumber Company, Limited, has been incorporated with a capital of $100,000, with head office at Winnipeg, Man. The provisional directors are R. P. Ward, E. A. Konantz, C. J. Lee. W. F. Senn, and R. Fair.

Blagdon, Limited, has been incorporated with a capital of $100,000, to carry on business as a general land and building company, with head office at Toronto. The provisional directors are L. F. Black and H. A. Hall.

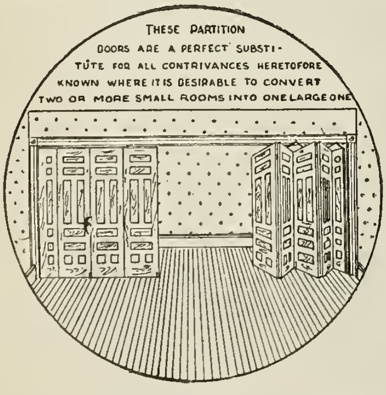
The Canadian Sand and Gravel Company, Limited, has been incorporated with a capital of $100,000, with head office at Thorold, Ont. The provisional directors are J. Battle and W. M. German.

The Merchants Building Company, Limited, has been incorporated with a capital of $3,000,000, with head office at Montreal. The provisional directors are H. J. Hague, K.C., C. G. Heward and A. E. Woodworth, all of Montreal.

The Metal Shingle & Siding Company, of Manitoba, Limited, has been incorporated with a capital of $500,000, with head office at Winnipeg. The provisional directors are N. J. Dinnen and H. P. Grundy, of Winnipeg.

Toronto, Ont.

The National Iron Works has obtained a permit from the building inspector for the erection of a pipe foundry to be located at the foot of Cherry Street, Toronto. It will be one storey in height and the construction will be of brick, steel, cement and gypsum. The estimated cost is $50,000.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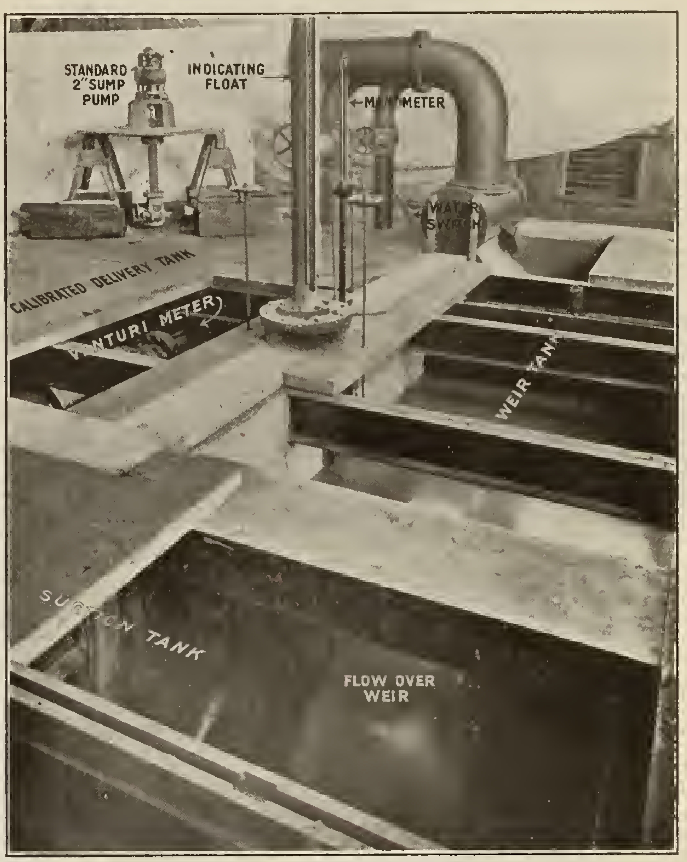

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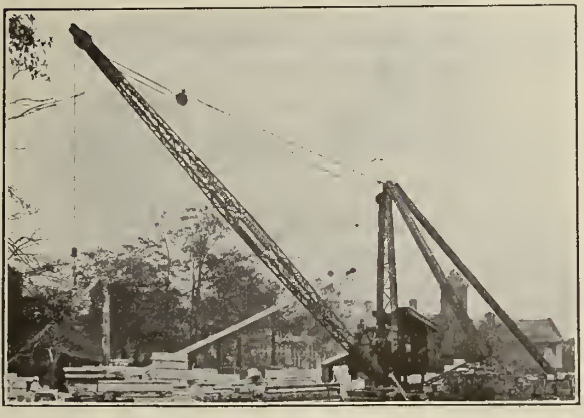

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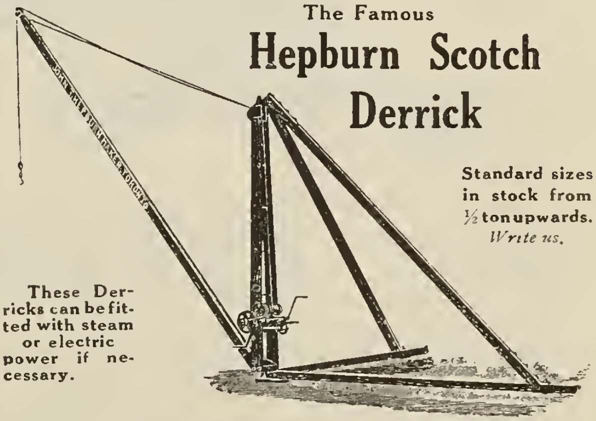

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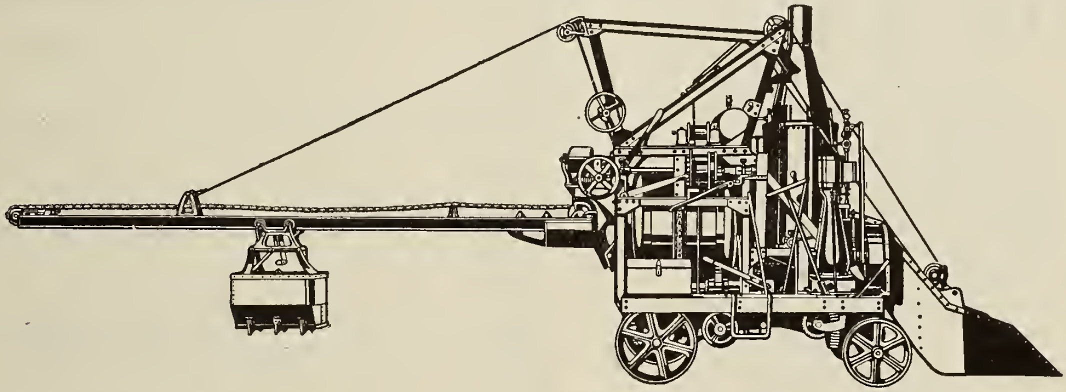

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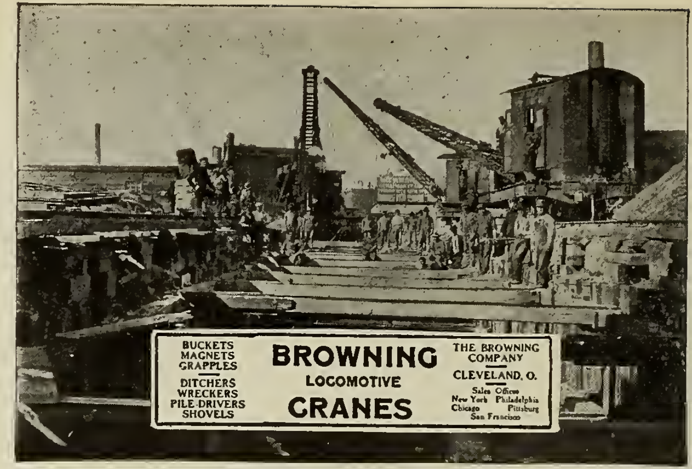

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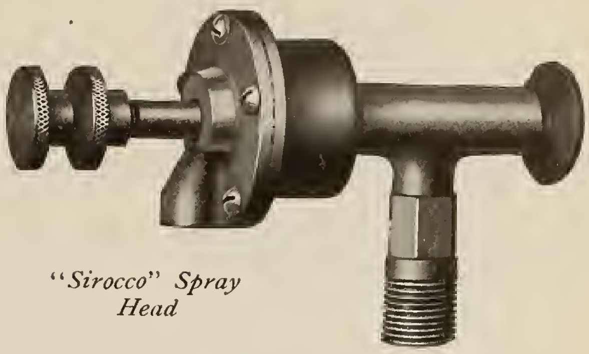

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It's the design and operation of the spray heads that's responsible for the efficiency or inefficiency of an air conditioning system.

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Purifiers, Coolers and Humidifiers

are equipped with spray heads which were designed to overcome the usual "clogging up" trouble. All heads can be flushed simultaneously by slightly turning a three-way cock located on the **outside** of the Purifier.

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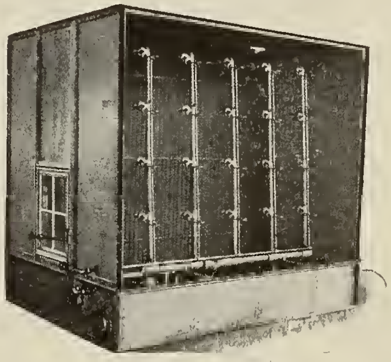
All heads are made of brass and accurately machined to template.

No packing is used.



Purifier Complete

Architects, Engineers and Contractors are invited to ask us for any information whatsoever regarding the design, construction, operation and application of Sirocco purifiers, Coolers and Humidifiers.

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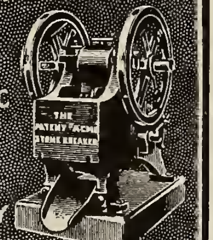
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Combine Beauty, Strength and Durability.

Write for Catalog "FIFTH EDITION" illustrating the standard sizes, colors and many of the special shapes.

SAMPLES—miniature or full size, will be forwarded, if desired.

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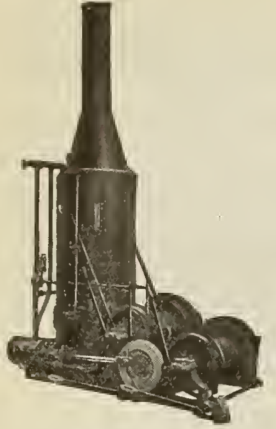

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We design and build Hoisting Machinery of all kind

MARSH & HENTHORN, LIMITED, BELLEVILLE, ONT.

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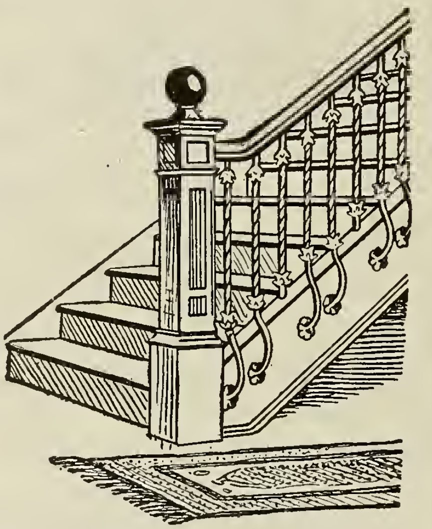

Fires in residences often force the occupants to jump from windows because the stairs are burning.

The fireproof house should have fireproof stairs—the next best safety device to fire escapes. Iron stairs are handsome in appearance, practically as cheap as wood and occupy less space.

Sure we'll send you our catalogue showing many photos of this equipment and quote you on that job you have in hand.

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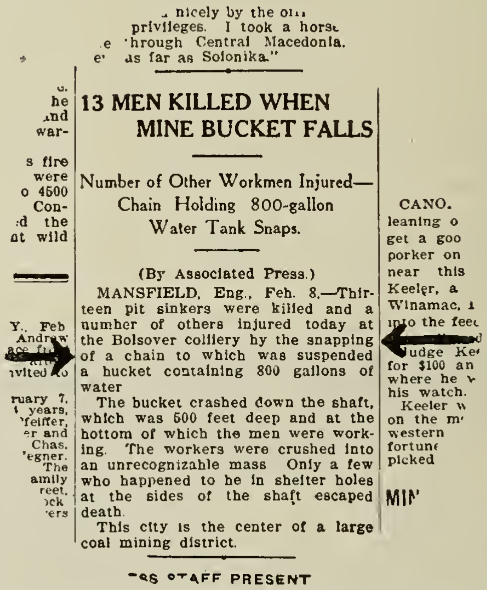

13 MEN KILLED WHEN MINE BUCKET FALLS

Number of Other Workmen Injured—Chain Holding 800-gallon Water Tank Snaps.

(By Associated Press.)

MANSFIELD, Eng., Feb. 8.—Thirteen pit sinkers were killed and a number of others injured today at the Bolsover colliery by the snapping of a chain to which was suspended a bucket containing 800 gallons of water

The bucket crashed down the shaft, which was 500 feet deep and at the bottom of which the men were working. The workers were crushed into an unrecognizable mass Only a few who happened to be in shelter holes at the sides of the shaft escaped death.

This city is the center of a large coal mining district.

Save money as well as loss of life and property by using a Canadian made electric-welded chain

McKinnon Chain Company
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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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of all types and sizes, Heaters, Tanks, Pumps, etc.

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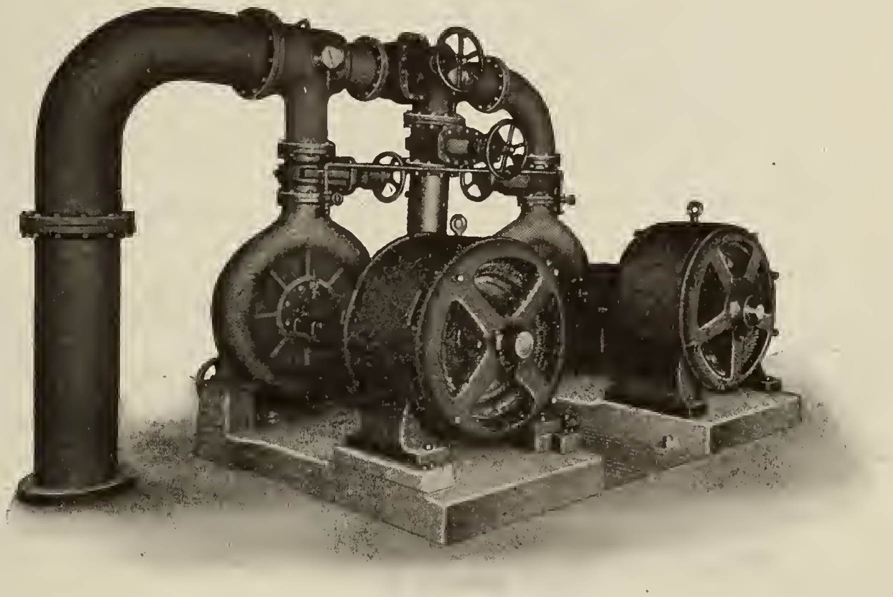
Any capacity or pressure



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Lifetime Lasting
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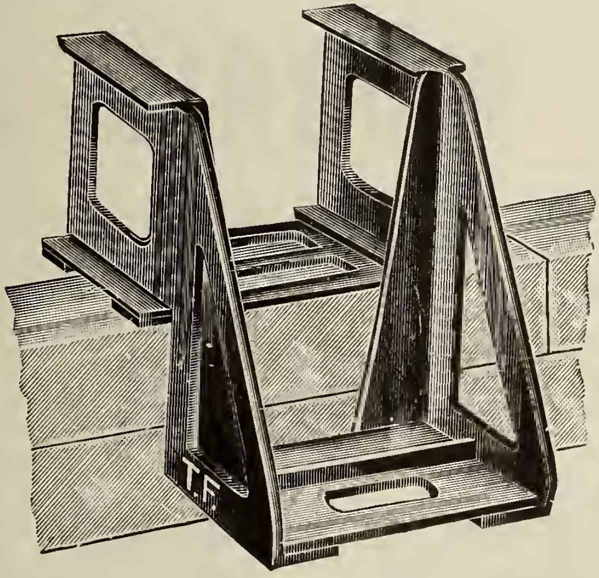
WALL AND JOIST HANGERS (MALLEABLE IRON)



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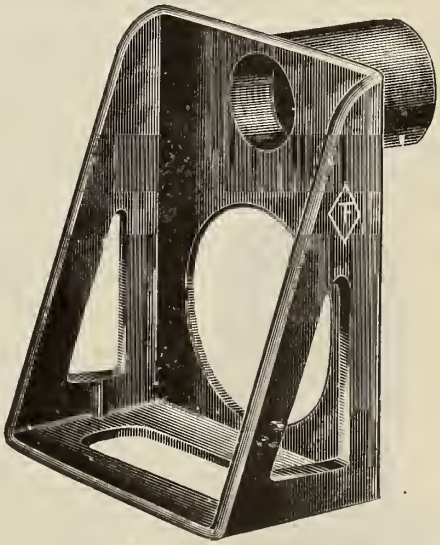

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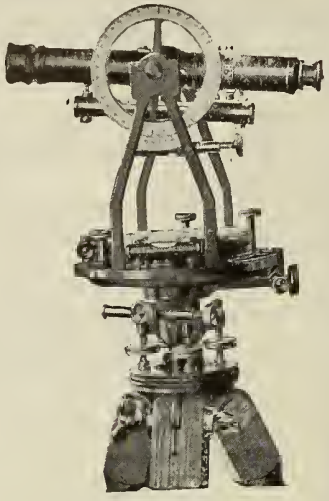
In response to a demand

for a very light transit for rapid work, we introduced in 1887

The Gurley Reconnoissance Transit



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Price complete, $115.00
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Its continued popularity is due to its medium weight (about 7¾ lbs.), its reliability for a variety of uses and its reasonable price.

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Lime	Fire Brick
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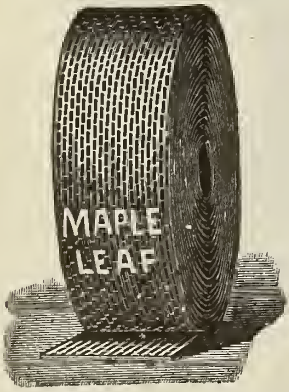
The reason is not hard to find, for there is no part of your Belting system, from the main drive to the smallest light Belt for power transmission, where you will not get the best kinds of service from



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It is the most economical Belting because it is durable under every condition; even where other Belting will deteriorate rapidly. It is water proof.

It runs absolutely true on the Pulleys.

It is built of plies of selected duck.

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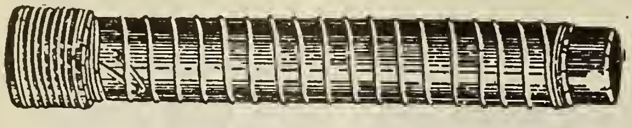

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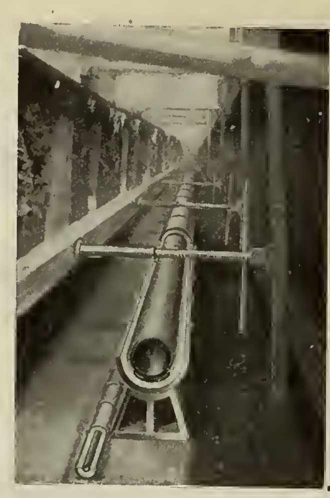

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Bulletin 102 **Edition 2**

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n the Maine work through the driving, filling of cofferdam pockets, unwatering and pulling of piling offer strong evidence of the success which is achievable in cofferdam and foundation work by proper use of this sheet piling. A copy of this bulletin will be sent to engineers and contractors on application.

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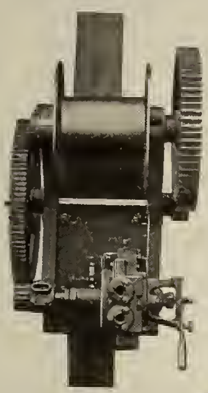

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MOTOR CRABS
SWINGING ENGINES

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Agents:
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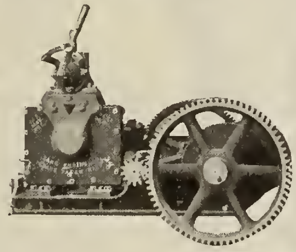

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in Sawn Slabs

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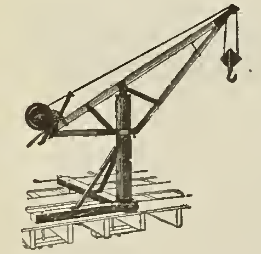

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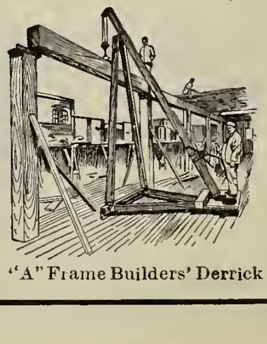

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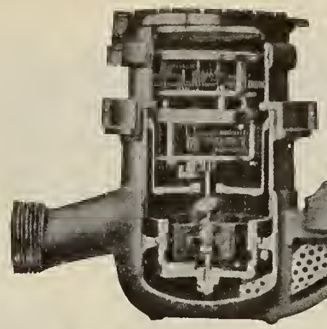

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Siemens have been making water meters for the last fifty years.

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5—It is more ductile and flexible than other asphalts.
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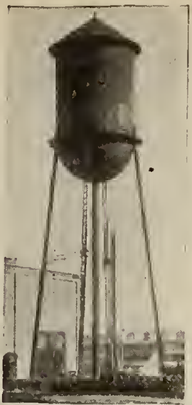

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Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11.50 to $12; wire-cut brick for foundation work, $9.50 to $10; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $32; sand-lime brick, $8.60, King Edward siding; $7.50 at the mill; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving. $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 66c per gal. of 9 lbs.

Raw linseed oil—in bbls., 63c per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 69c.

MONTREAL PRICES

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15c basis per pound; British manilla, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 65c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 lbs.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

(Continued on page 106)

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Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

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The Exeter Concrete Mixer as shown by accompanying illustration, is a batch mixer, drum type, with discharge chute. We claim good workmanship, high grade materials, and the best mechanical design, which gives a machine of the very best wearing qualities. The drum is made of a high grade semi-steel and all parts are carefully and accurately fitted, with sufficient strength to insure a minimum maintenance cost.

The mixers are equipped with either steam engine and boiler, power loader, gasoline engine, electric motor, belt or chain drive, or without power, as may be desired, and on either steel trucks or skids. These machines can be arranged to work as hot mixers, for melting asphalt, thawing out material and mixing bituminous macadam. Estimates furnished for any type mixer required.

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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from p. 104.)

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.40 per 100 lbs.; square twisted, $2.50 per 100 lbs.; channels, angles, beams and plates, $2.90 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $9.00 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.75; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25; all less 40 per cent.

SUNDRIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10 per 100 lbs.

Boiled linseed oil—in bbls., 85c per gal. of 9 lbs.

Raw linseed oil—in bbls, 83c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

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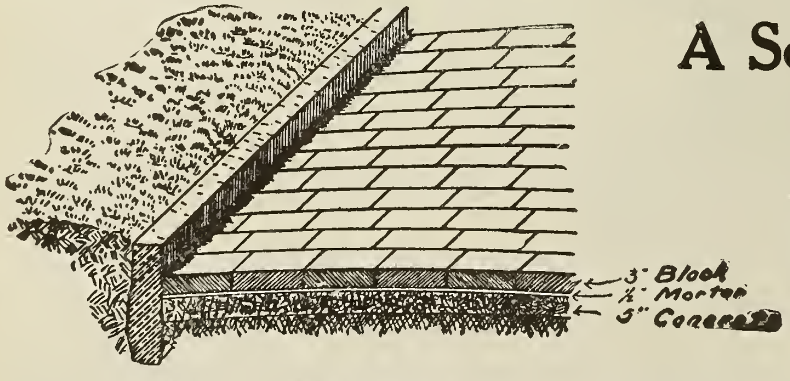

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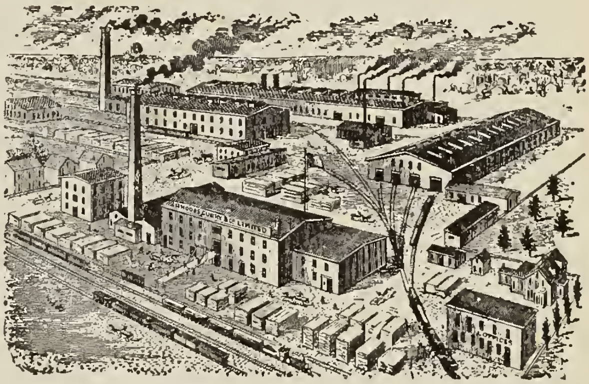

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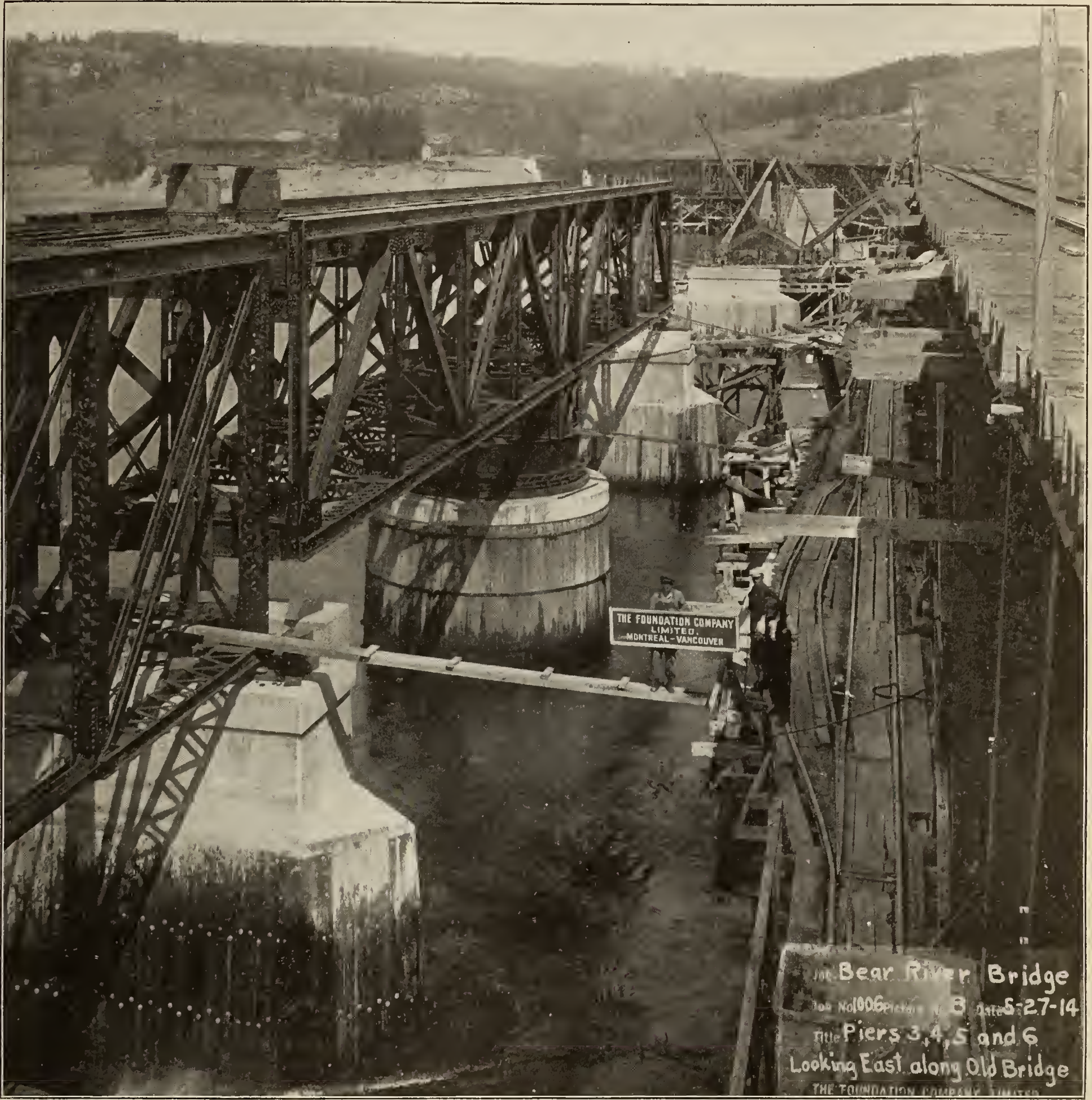
THE FOUNDATION COMPANY LIMITED. MONTREAL-VANCOUVER
Bear River Bridge
Job No 1006 Picture No 8 Date 5-27-14
Title Piers 3,4,5 and 6
Looking East along Old Bridge
THE FOUNDATION COMPANY LIMITED

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The above piers were built by dredging open caissons through sand, clay and gravel to a firm foundation, the deepest being founded 86 ft. below High Water Level. A 24 ft. tide at this point greatly added to the difficulties of construction which was carried out through the most severe winter weather.

Your inquiries are solicited on any kind of difficult foundation work

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"Erie" Barrow No. 23 has a solid welded steel tray of uniform thickness and great strength. The handles are given an extra bend to put tray load more over wheel.

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This is a deep barrow for carrying concrete or other sloppy material. Wheel guarded and forward dump.

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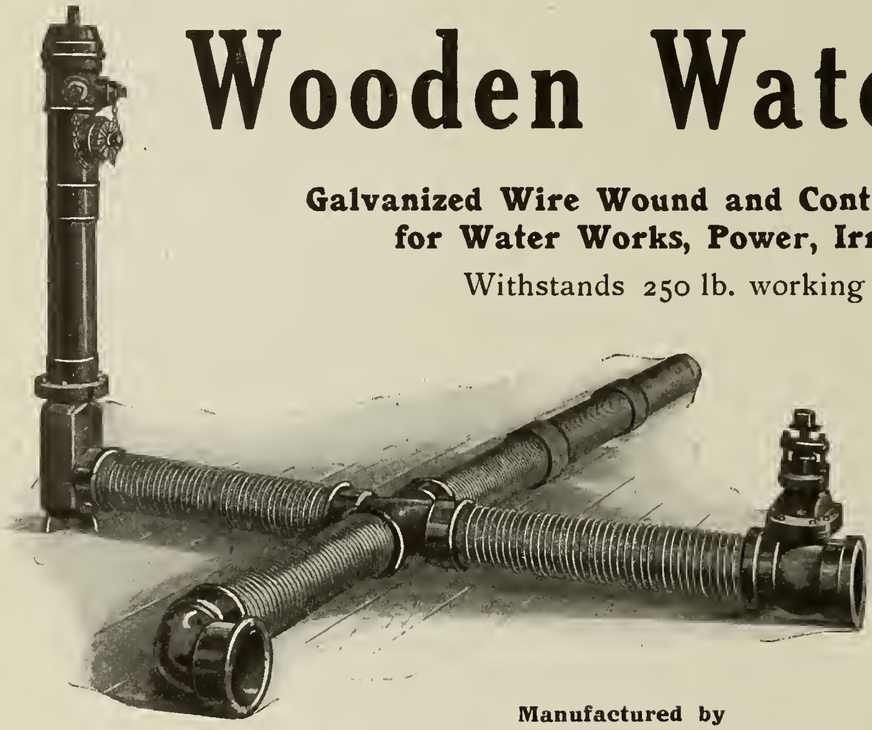
Withstands 250 lb. working pressure.



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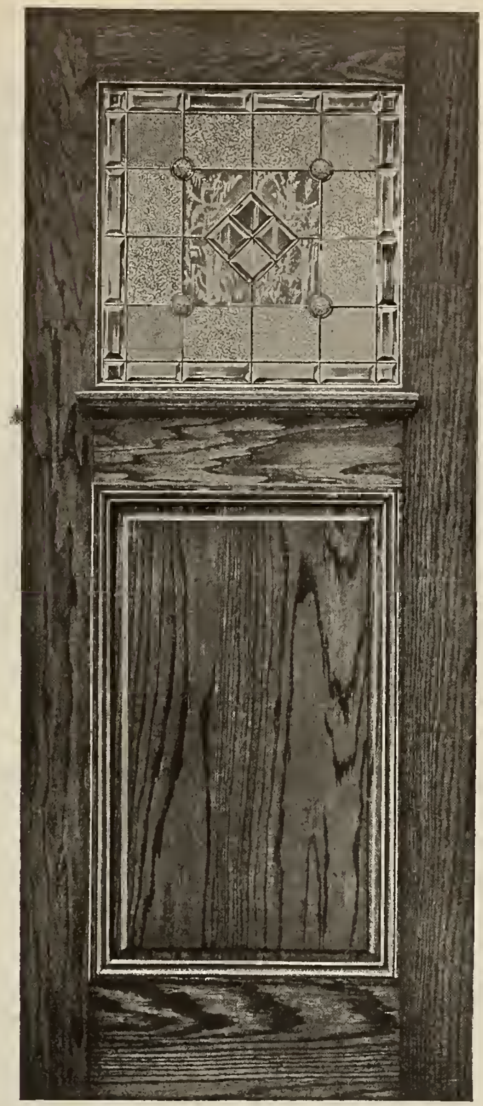
Balusters
Columns



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IF you want high-class doors of good appearance and made of selected woods, we suggest Batts Limited as the place to get them. The workmanship in our doors is thorough and all woods are properly seasoned giving the doors long life.

In our columns the special "V" lock joint makes it impossible for them to crack or open.

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Clay, Slag,
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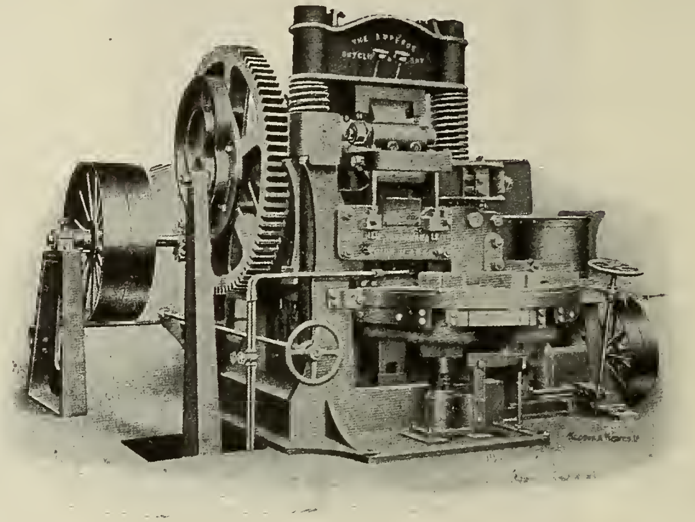

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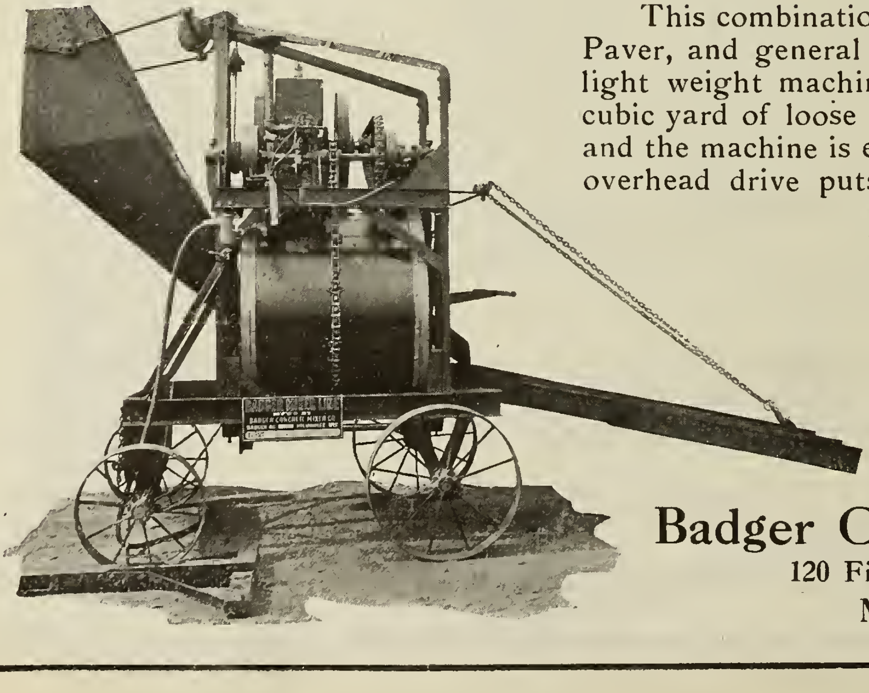
CABLES—"Utilization Leigh" CODES—A B C. 5th Edn. McNeill 1899 Edn.

LANCASHIRE, ENG.

Badger Road Builder Street Paver and Mixer



This combination Badger Road Builder, Street Paver, and general purpose Mixer, is an all-steel, light weight machine, with a capacity of one-half cubic yard of loose material. The wheels are high and the machine is easily moved by two men. The overhead drive puts the engine out of the way, enabling the crew to work on all sides. The Badger is the simplest, strongest and best designed road builder and street paver on the market. This is the only Mixer that will meet all the various requirements of the contractor for efficiency and general utility. No vibration.

Write for our prices—they will interest you.

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It would be entirely to your advantage to have competitive prices on your requirements, and to have our prices even if only as a matter of record.

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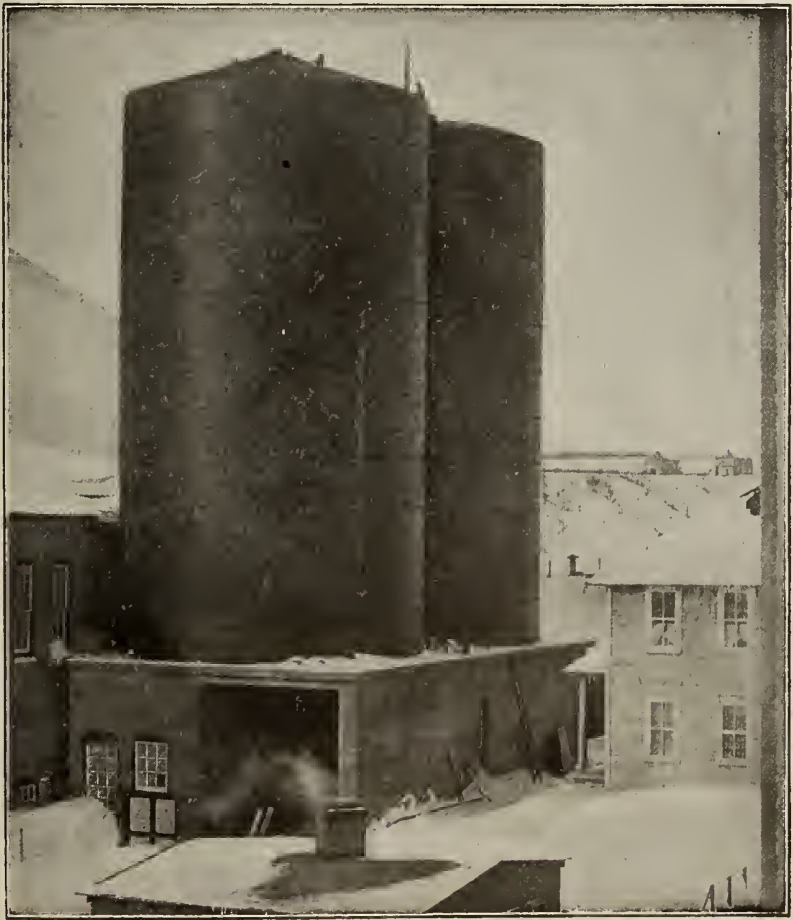

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This is Elmhurst Avenue, Highland Park, Mich.

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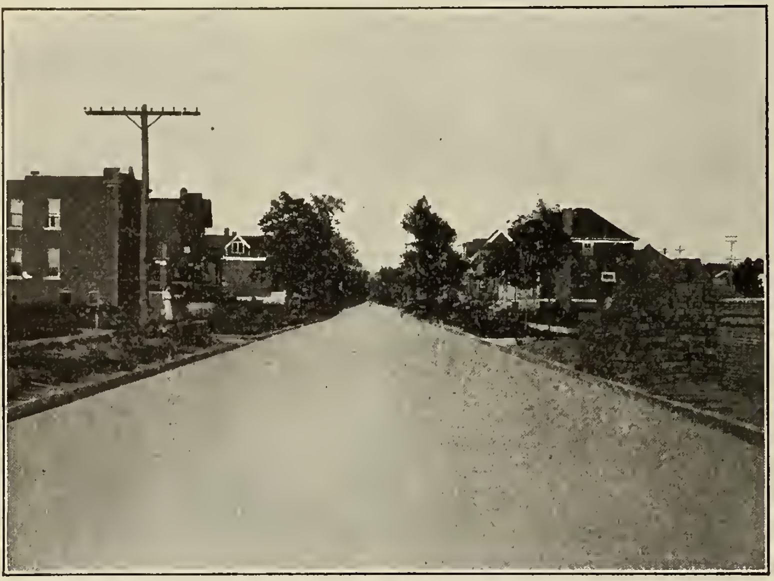

Do you know of all the epoch making advances in concrete road and pavement construction during the past year?

Write for our 1914 booklet and circulars—they are full of "up-to-the-minute-ideas" on concrete paving.

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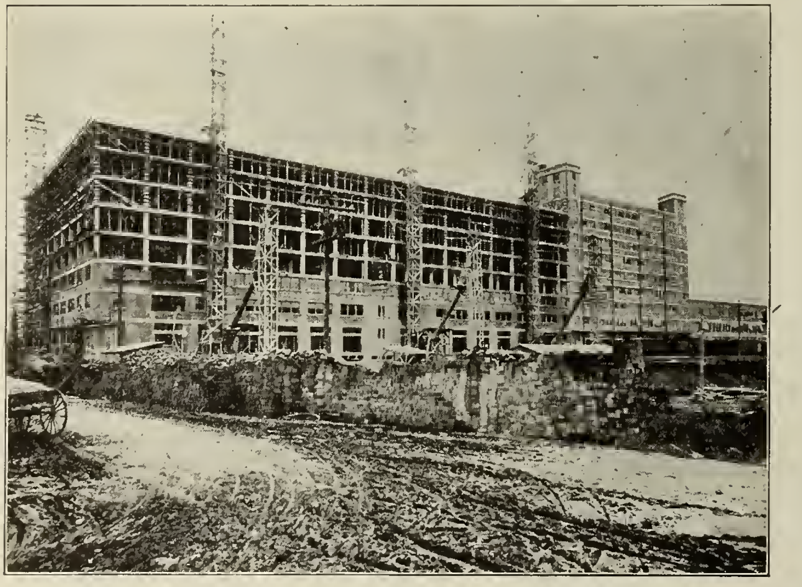

View of Sears-Roebuck Company Building, under construction, Dallas, Texas

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The recent decision of the Hon. Chas. A. Willard in the U. S. District Court of Minneapolis in the Drum vs. Turner concrete patent case sets at rest pretended claims of Mr. Turner's imitators.

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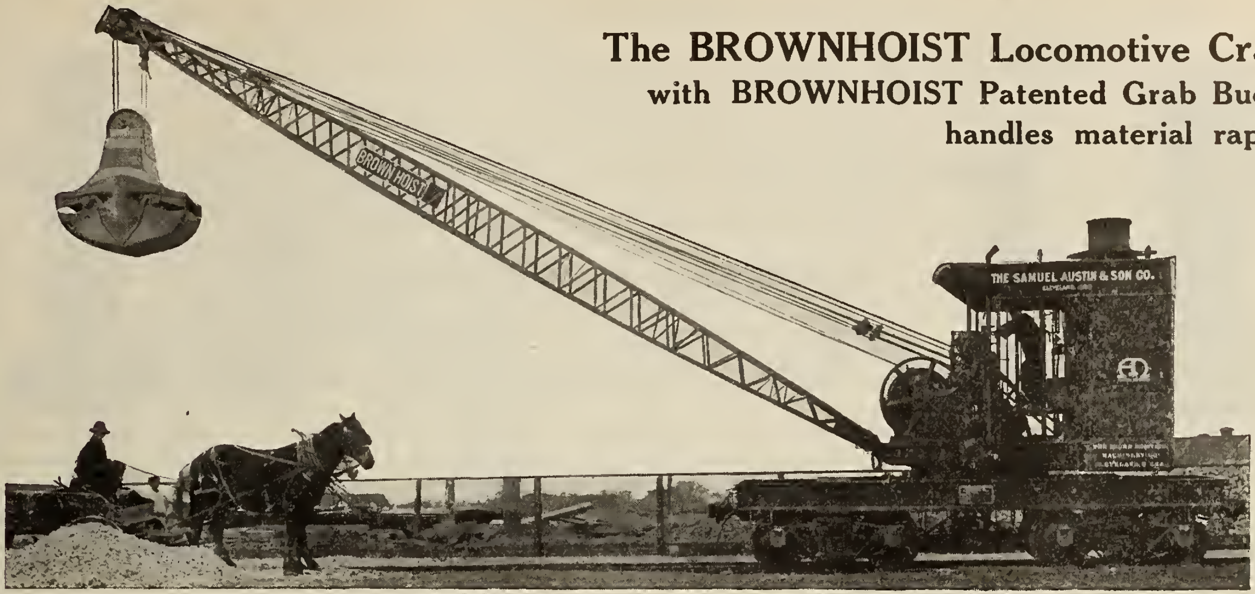

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with BROWNHOIST Patented Grab Bucket
handles material rapidly

Operated by one man, this crane with bucket handles coal, ore, crushed stone, sand, gravel, etc., 60 to 120 tons per hour, from and to cars, wagons, bins and stock pile. And Brownhoist Locomotive Cranes are built for hard and continuous service—thereby saving the owner costly delays and repairs due to frequent breakdowns. Ask the owners—they will tell you.

Write for catalog K which shows how and where this crane and bucket are being used.

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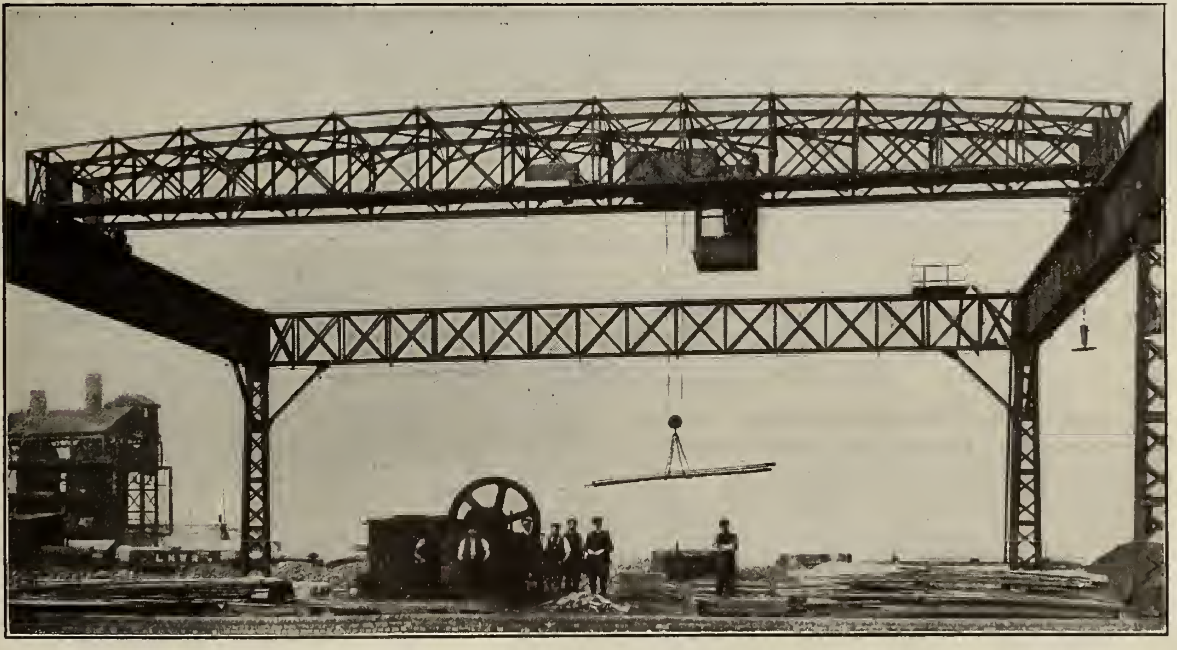

Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

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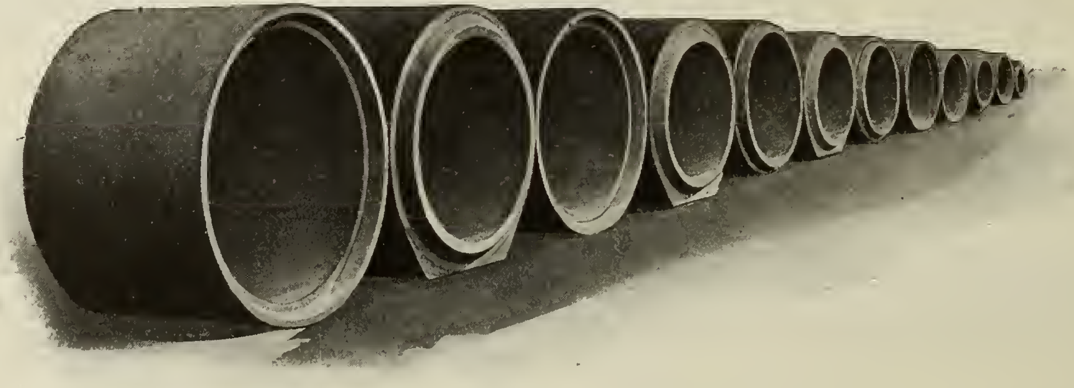
We make a point of supplying special ornamental trimmings for public buildings, churches and schools.

Your enquiries are respectfully solicited, and will receive prompt attention.



National Concrete Mfg. Company, Limited

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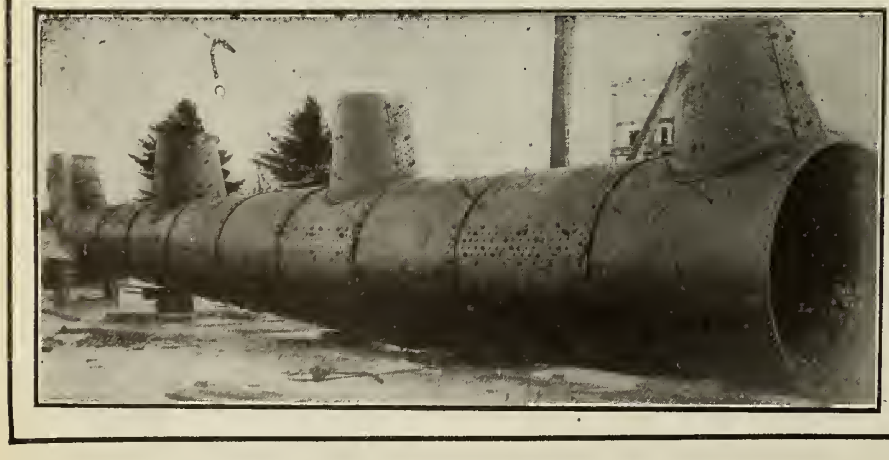

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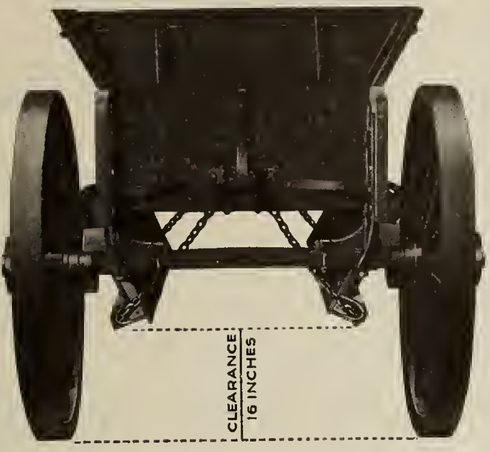

in a dump wagon is the best part of its price. When we chose the Watson Wagon we selected the highest priced dump wagon of the lot. You get exactly what you pay for in this world, and although other wagons can be bought for less we wanted the best so that we could go back to our customers with a clear conscience.

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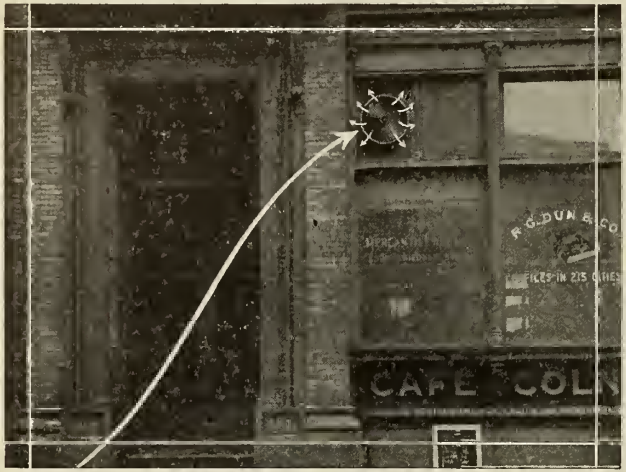
"BUFFALO" FANS
KEEP THE AIR MOVING



A "BUFFALO" DISK FAN

will remove that foul, overheated air and replace it with fresh invigorating air direct from the outside.

Why swelter next summer. Play safe. Equip with a "Buffalo" Disk Fan.

We offer a simple and inexpensive means of moving large volumes of air at low pressures or against small resistance. No other device is so effective or economical for cooling rooms in which heat is generated such as laundries, engine and boiler rooms, veneer rooms, etc.

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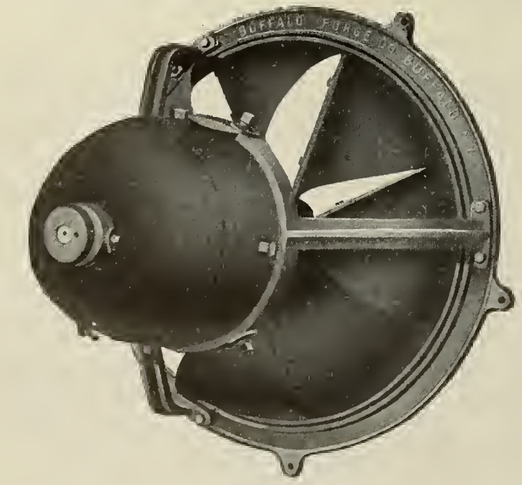
ST. JOHN MONTREAL TORONTO WINNIPEG VANCOUVER



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A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price $1.00.

Applied Perspective, by William P. P. Longfellow. Published in 1901 by Houghton, Mifflin & Company. 98 pages. Illustrated. Price $1.00.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price $1.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price $2.00

The Sanitation of a Country House, by Dr. Harvey B. Bashore. Published in 1905 by John Wiley & Sons, 102 pages. Illustrated. Price 50c.

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited, London. 618 pages, well illustrated. Price $2.00.

A Treatise on the Inspection of Concrete Construction, by Jerome Cochran, C.E. Published by Myron C. Clark Publishing Company. 594 pages. Price $3.00.

Foundations of Bridges and Buildings, by Jacoby and Davis. Published in 1914 by McGraw-Hill Book Company. 602 pages. Illustrated. Price $5.00.

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NOT because it is cheaper than other limes but because it has some advantages not found in other brands.

It is easily bedded down and does not set too rapidly, allowing the brick-layer to spread for more bricks. It requires but little time for tempering and sets hard as a rock.

Try "Renfrew" lime on your next job.

White Lime — Gray Lime
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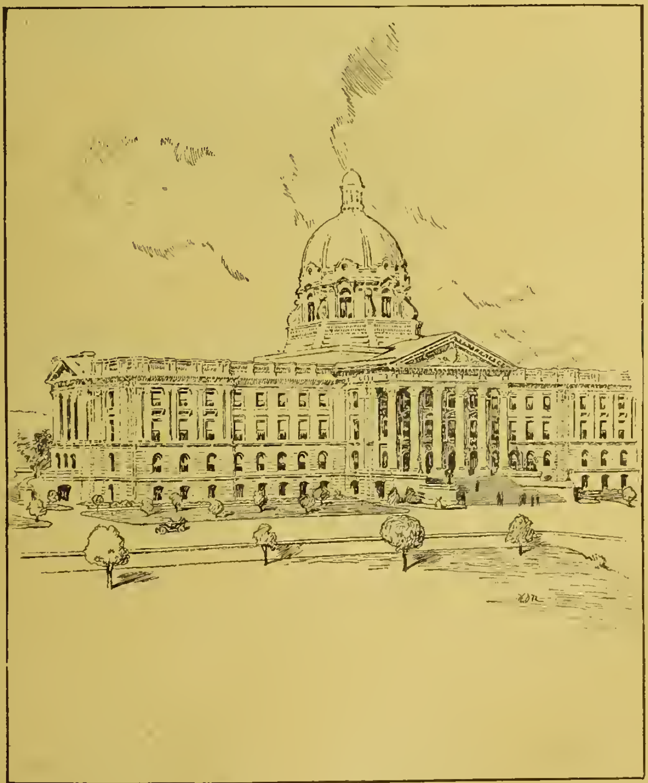
Jamieson Lime Company

Renfrew, Ontario



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This building was wired with

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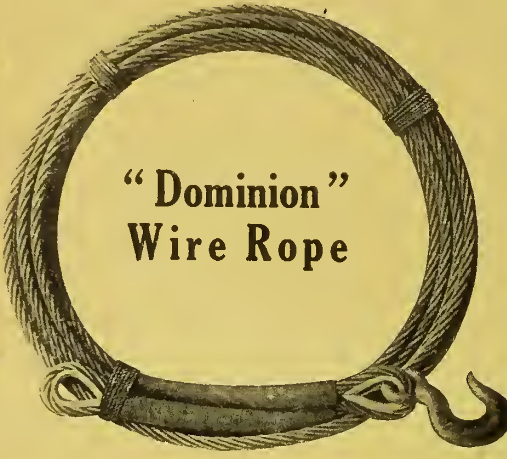

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We manufacture special ropes to take care of your particular needs.

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Locomotive-Coaling and Wrecking

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In capacities from
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For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.

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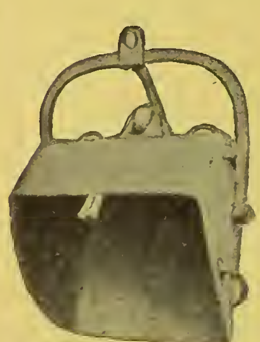
For Every Purpose



We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc., in all sizes.

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We supply CONTRACTORS' EQUIPMENT of all descriptions

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Vol. 28 Toronto, July 15, 1914 No. 28

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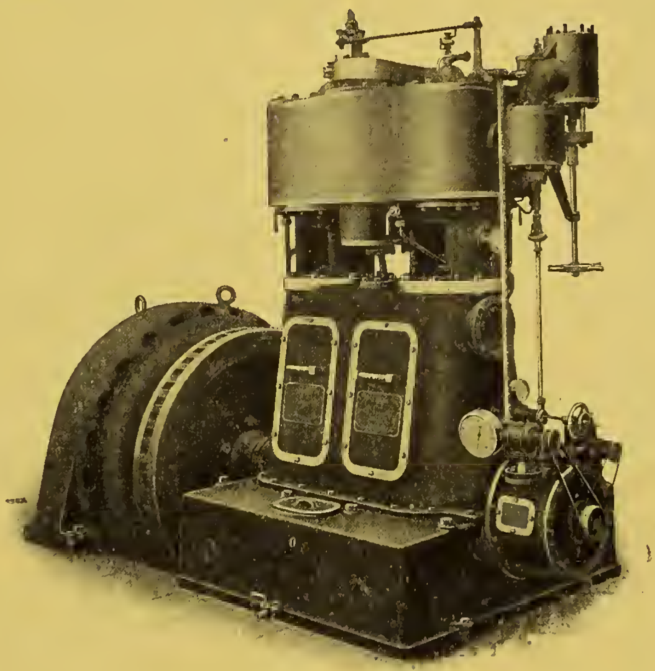

570 B.H.P. Belliss engine at 375 r.p.m.

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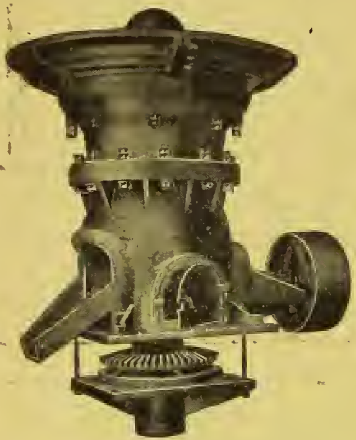


Mr. Contractor!

When in the market for Crushing Machinery, look into the merits of our

Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

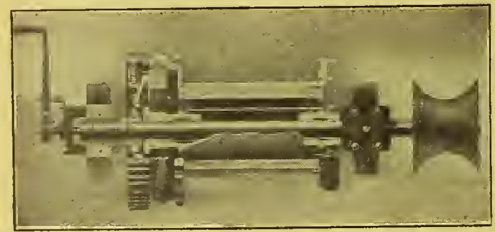
We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Vancouver and Nelson

If You Had to Run It Yourself Which Engine Would You Choose?



Suppose you were engineer of a hoisting engine, operating a clamshell bucket or running a derrick that required fast, continuous work, which would you prefer—an engine with an easy operating friction; easy to throw in, easy to hold in, or one with a friction that required violent effort to throw it in and equally violent effort to hold it there? That's the difference between

"AMERICAN" EXPANSIVE TYPE FRICTIONS

and the cone type universally sold with other engines—a type in which it is necessary to push the whole drum across the shaft and hold it there by main strength. The strength and weight of the operator and the push of the thrust screw have to do the whole job.

"AMERICAN" Friction supplements the push of the thrust screw with the toggle action of the friction; this produces a thrust several times greater than the unassisted push of the thrust screw.

An untired operator is bound to get better results than one fagged out by needless tussling with a cumbersome machine.

The cool running "AMERICAN" friction; quick, positive, easy to operate, will save you money. Make us prove it.

—MADE BY—

AMERICAN HOIST & DERRICK CO.

ST. PAUL, MINN.

SOLD BY—

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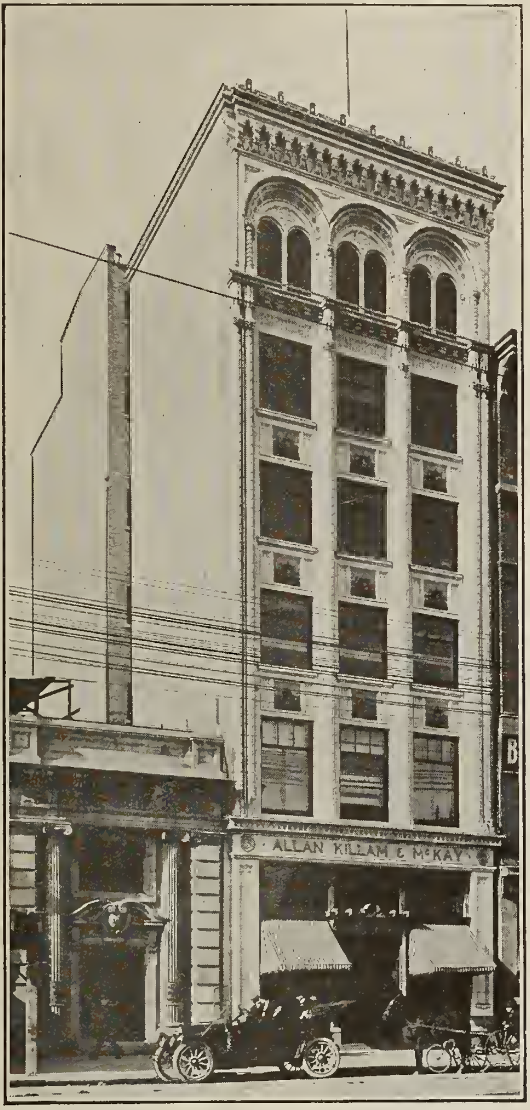


Reinforced concrete office building of Allan, Killam & McKay, Winnipeg, Man., Agents for Allan Line Steamships—Architects: J. D. Atchinson & Co.—Contractors: Hazelton & Walin, Limited. Canada Cement used exclusively.

The Adaptability of Concrete to Buildings

The fact that concrete may be moulded into almost any form, makes its use particularly advantageous in buildings necessitating special construction.

Its great strength, economy and durability destine it to become the ultimate standard for office building construction.

Concrete buildings are fire, water and vibration proof. They reduce cost of maintenance to the minimum. They enable greater window area and consequently more inside light.

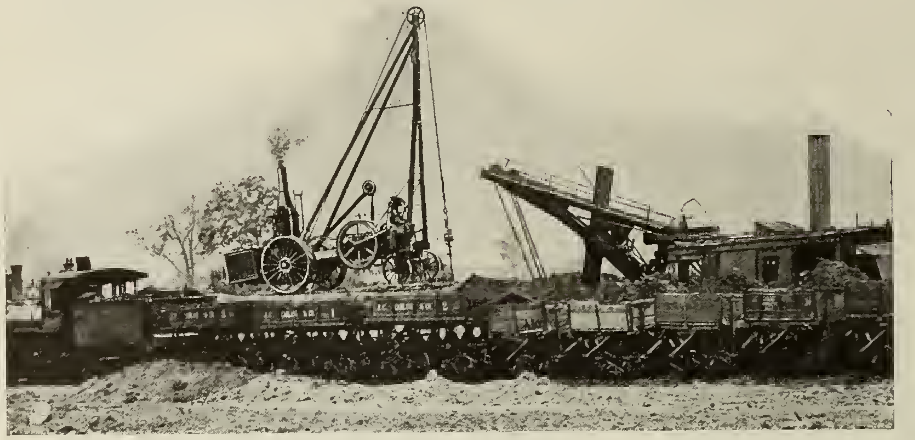
The possibilities of this form of construction are shown in a very complete manner in our 224 page book "Factories and Warehouses of Concrete." This book will be sent to Engineers and Contractors upon request.

Information Department

Canada Cement Company Limited

886 Herald Building, Montreal

Mammoth to Pigmy



One of four **CYCLONE BLAST HOLE DRILLS** owned and operated by J. C. Carlin, R. R. Contractor.

Drill shown is of the Steam Traction Type. Weight of drill 13,500 pounds.

One of several **HOLMAN STEEL TRIPOD DRILLS** owned by the Canadian Government. Weight of Drill and Tripod 550 lbs. Drill shown is working on an excavation for Government Building, Ottawa, Ont.

Drill operating on steam.

Two of ten **HARDY HAMMER ROCK DRILLS** owned by Moran & Stapleton, Contractors. Weight of drill 26 lbs. Drills shown working on sewer excavation at Carleton Place, Ont.

These drills are supplied with air from an Abenaque Portable Gasoline Driven Compressor, three of which are in use.

Mussens Limited

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Winnipeg, 259-261 Stanley St. Quebec, 31 St. Louis St.
Calgary, 10th Ave. and 3rd St. E. Halifax, 78 Granville St.
Cobalt, Opp. Right of Way Mine Vancouver, 101 Water St.

We Supply
Drills for Every Service

CYCLONE BLAST HOLE DRILLS are essentially valuable for Railroad Contracting and large Quarry Operations, where great quantities of Rock have to be moved.

No. 14 Cyclone Blast Hole Machines will drill holes at the lowest possible cost per ton of rock displaced.

Cyclone Drills are made in several different sizes with steam, gas, or electric power and in portable or traction type.

HOLMAN TRIPOD PISTON DRILLS are of steel construction and are absolutely necessary for construction and quarry work, where blast hole drills cannot be used to advantage, because of inability to use heavy blasts, put in deep holes or on account of comparatively low tonnage required.

Holman Steel Rock Drills are made in six different sizes and are carried in stock.

HARDY SIMPLEX HAMMER DRILLS are extremely useful for block hole work after a blast hole or tripod drill. For sewer construction they are immensely superior to Tripod Drills owing to their requiring no "setting up" and their high efficiency. Hardy Hammer Drills will operate successfully on air supplied by the ordinary Steam Driven Westinghouse Compressor and should be a part of every Contractors Steam Shovel Equipment. Carried in stock in two sizes.

Mussens Limited are the Sole Canadian Agents for the Cyclone, Holman and Hardy Drills. We can supply your Drill requirements whatever their nature. Our experts are at your service and if you want drill information we can give it to you. Write for Catalogues to our nearest office.

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(Continued on page 12)

Principal Business Street in Wheeling, W. Va., Paved with Bessemer Block

Roads that Outlast the Bond

Long after the bond issue is redeemed you will have a permanent road surface that will remain to render efficient service for many years if you specify

BESSEMER WIRE-CUT-LUG PAVING BLOCK

Bessemer Block is manufactured from selected shale and the patented process of manufacture produces a paving block of astonishing toughness and durability. Smooth, uniform—***four inches of actual wearing surface.*** Minimum upkeep cost. Wire-cut-lug block provides a gripping surface for the cement grouting. The road illustrated above is one of hundreds of Bessemer paved roads that are giving service and satisfaction in many large cities and in country districts.

Our Free booklet tells you all about Bessemer Block. Let us send it to you—mail us your address.

BESSEMER LIMESTONE COMPANY, YOUNGSTOWN, OHIO

Manufacturers of Bessemer Repressed and Dunn Wire-Cut-Lug Paving Block.

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MADE IN Sirocco TRADE MARK, **CANADA**

A WORD FOR EFFICIENCY

"Sirocco" Multi-Blade Fan wheel built with capacities from 75 C.F.M. to 1,000,000 C.F.M. in single and double inlet types.

The word **"Sirocco"** applied to apparatus for Purifying—Cooling—Humidifying — Heating — Ventilating — Drying and Mechanical Draft stands for **a guarantee** of **highest efficiency.**

The **"Sirocco"** is the original fan of the many blade plan. **"Sirocco"** Fans save time over other types, because their design is such as to make use of **every bit** of energy with the least possible waste.

In specifying "Sirocco" Fans you're SURE they'll do exactly as claimed

A "Sirocco" Multi-Blade Fan will handle more air consuming less power than the ordinary steel plate fan twice the diameter.

Upon request we will gladly send to you a complete set of our Bulletins and Catalogues

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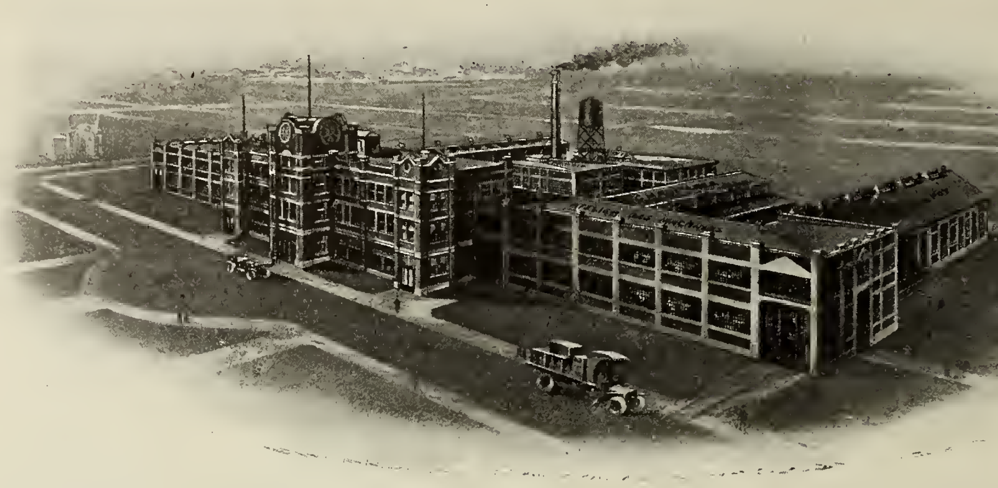

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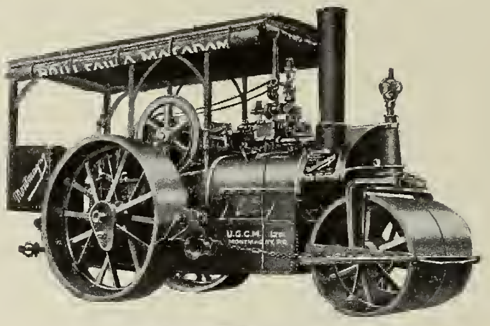
"Montmagny" Modern Road Builders

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"

"Montmagny" Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

"Montmagny" Portable Steel Bin.

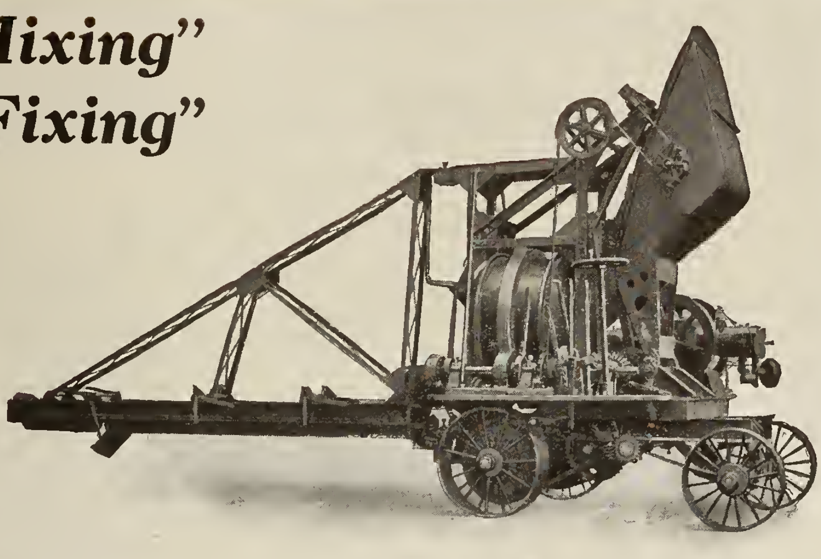
Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

"Most Mixing"
"Least Fixing"



M-C Rail-Track Paver, With Gasoline Engine, Showing Mixing Distributer.

M-C Rail-Track Paver

Points too valuable to overlook. Compare them with those on other machines. That's all we ask.

Traction

12 horse-power steam or gasoline engine;
Two speeds ahead, one speed reverse;
Heavy brakes like on auto trucks;
Powerful differential;
Extra large wheels;
Right height to pass under city viaducts;
Drives like a traction engine, up hill or down;
Sell your horses—you don't need 'em.

Operation

Perfect one man control;
Engineer works in one natural position;
No stooping or stretching;
Engineer rides when traveling;
Levers all at fingers' ends;
No expert needed to handle distributer;
Safety first—gears covered.

Capacity

Continuous mixing;
11 to 12 cu. ft. of wet mixed concrete, or 2 bags 1-3-5 per batch;
Daily capacity, 1200 to 1400 street yards, 6 ins. thick.

Mechanically, the M-C Rail-Track Paver is as well built as we know how to build it. It has all the strong features of the M-C standard mixers:—**Semi-steel Drum, Steel Rail Tracks; Segmental Gear; Dustproof Roller Bearings, Etc., Etc.**

Send for free catalog explaining it in detail.

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Manufactured by
Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

NOTE THE PERPENDICULAR POSITION OF THE Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch **in the air**—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that **does more work.**

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: **CANADIAN-ALLIS CHALMERS CO., LIMITED**

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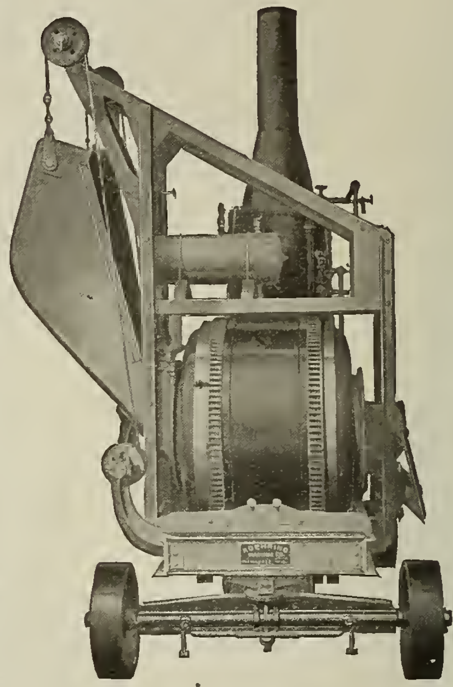

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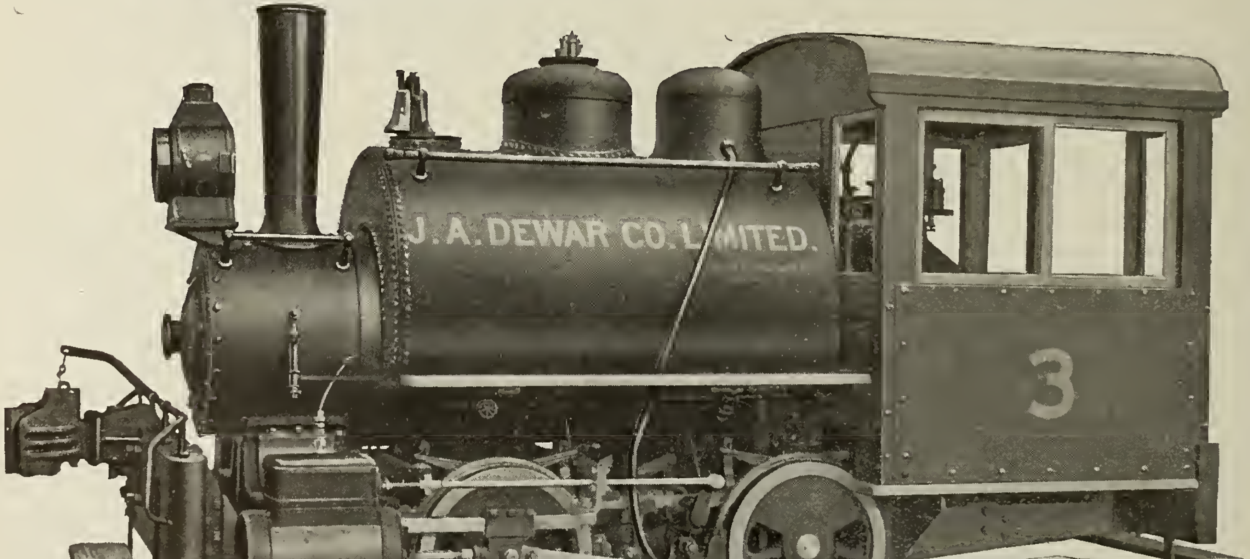

High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

Standard Hoisting Engine

The London Concrete Machinery Co., Limited

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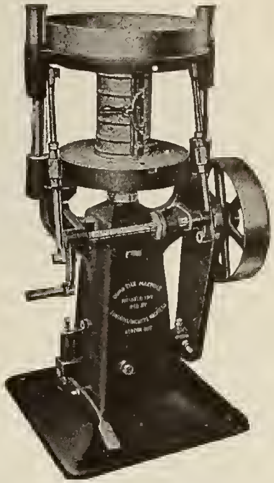
the Largest Manufacturers of Concrete Machinery in Canada



Dunn Cement Drain Tile Machine

Concrete Mixers

—

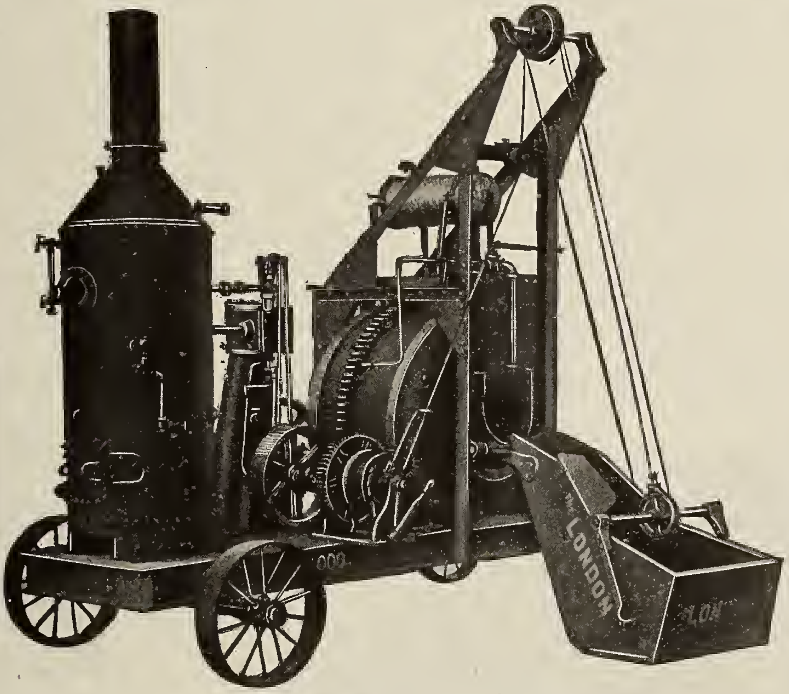
Mortar Mixers

—

Concrete Block Machines

—

Cement Brick Machines



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

—

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—

Pumping Outfits

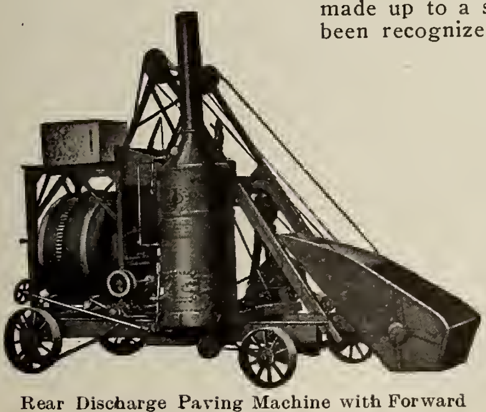
—

Hoists and Derricks

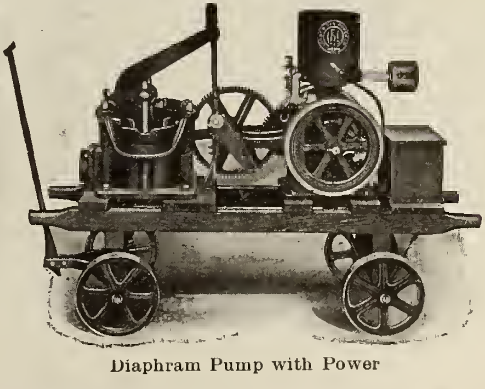
Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.

Correspondence Solicited.



Rear Discharge Paving Machine with Forward Loader.



Diaphram Pump with Power

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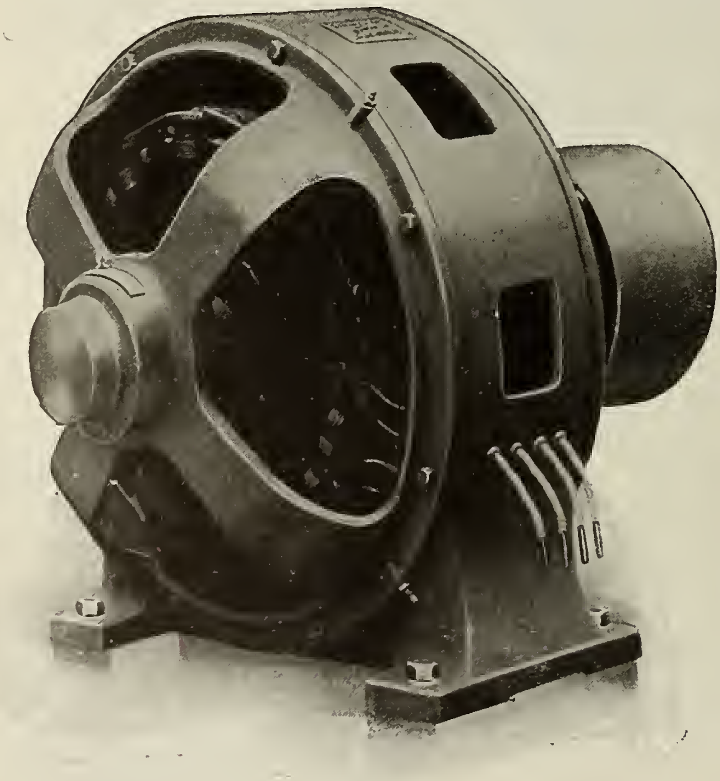

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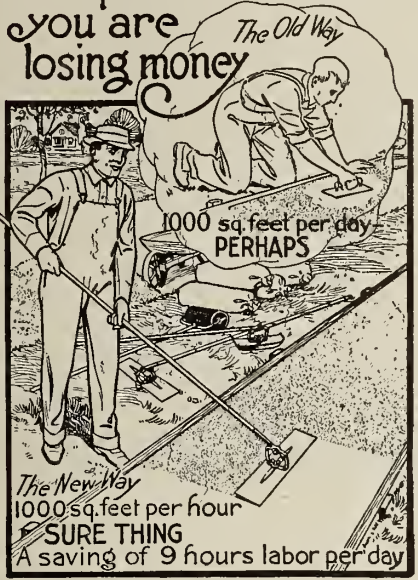
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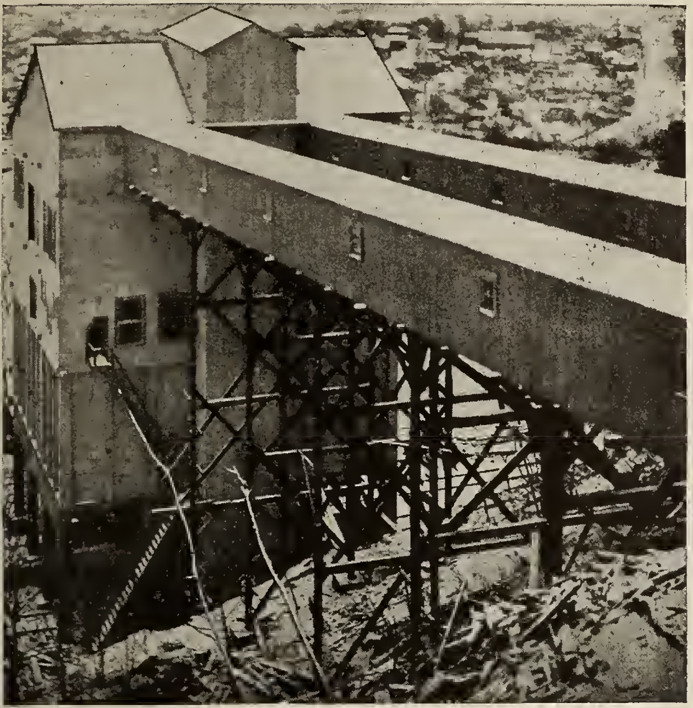

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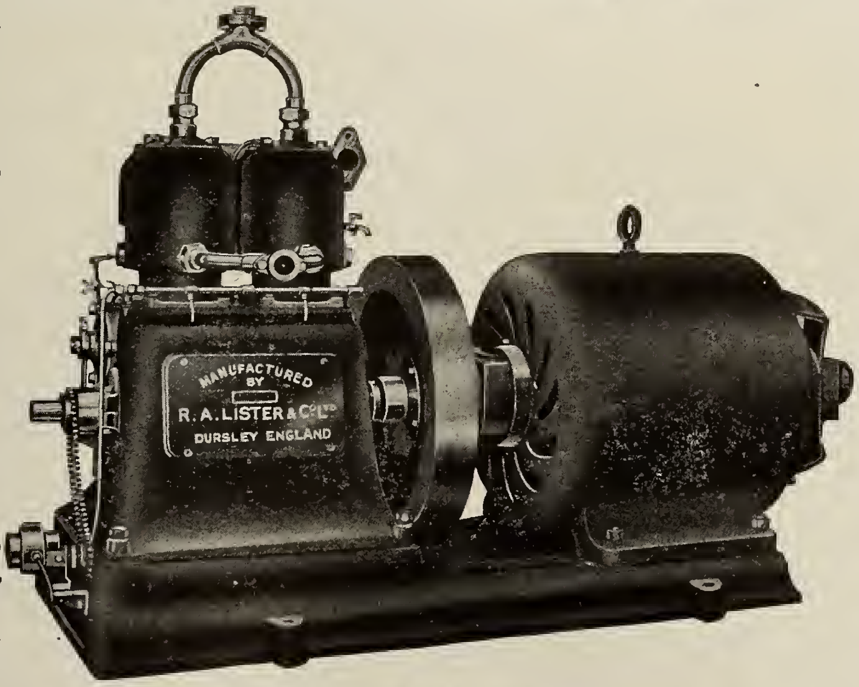

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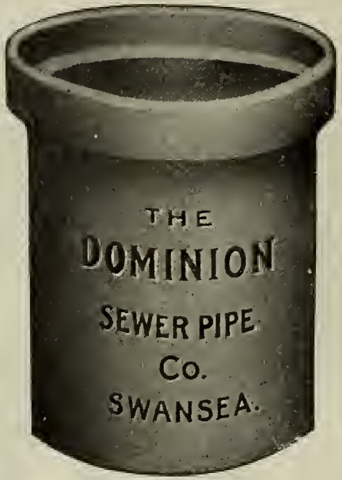

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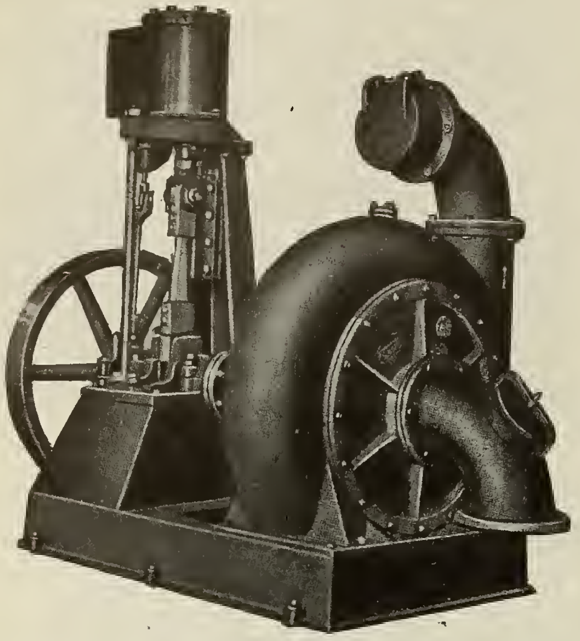

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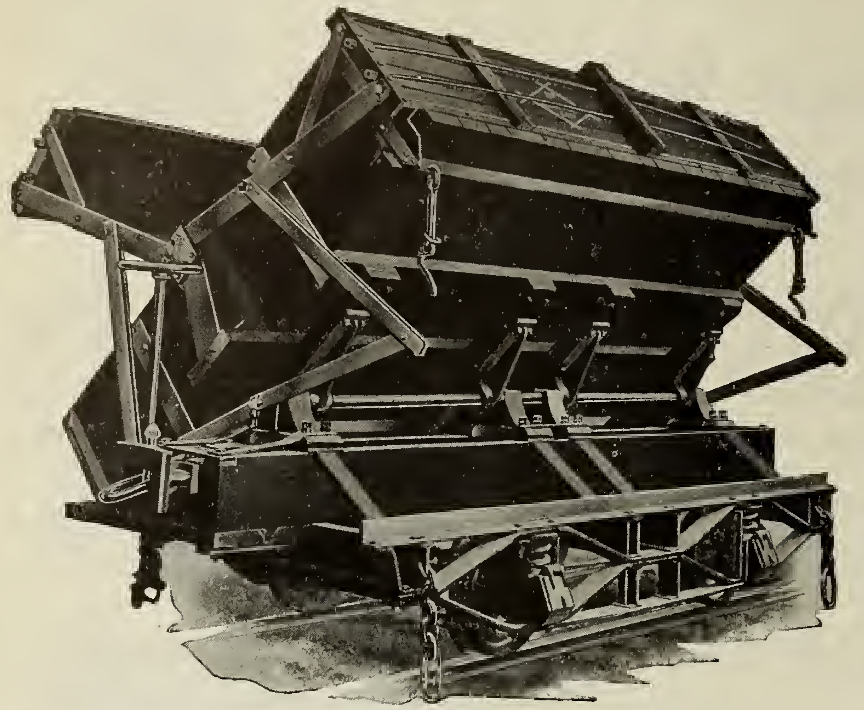

Cut showing 4 and 6 yard Double Diamond Steel Frame Car in dumped position. Full 45 degrees. Door opens away from load.

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Watch next week's issue!

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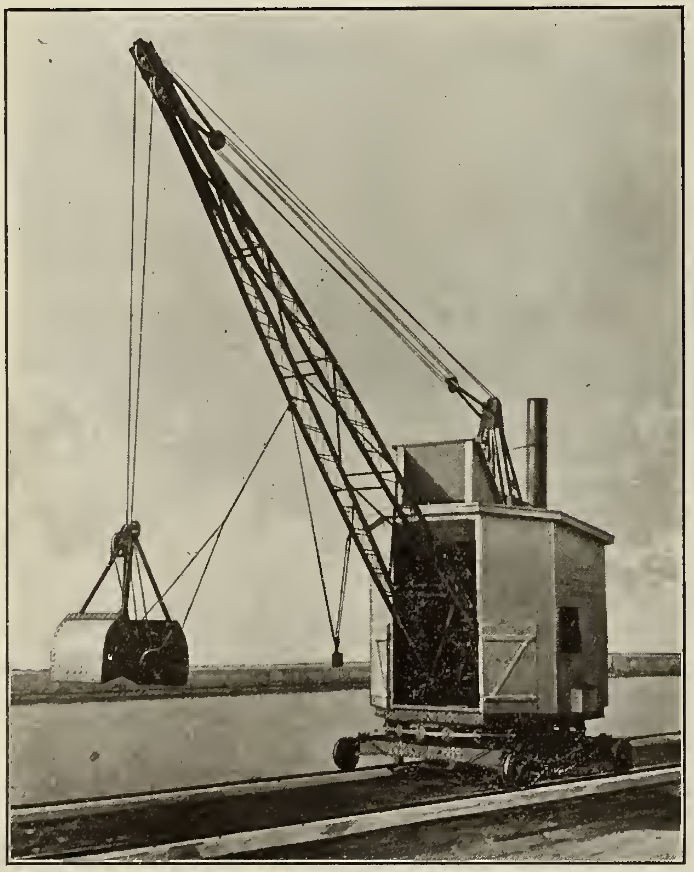

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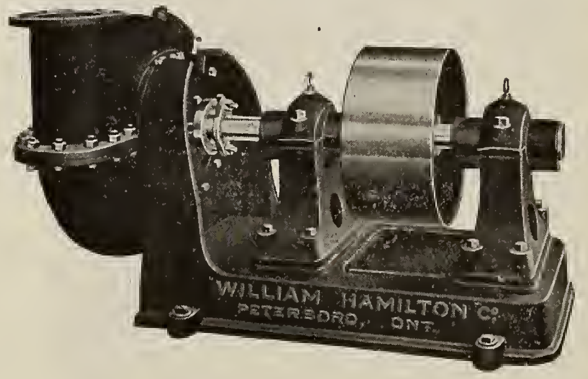

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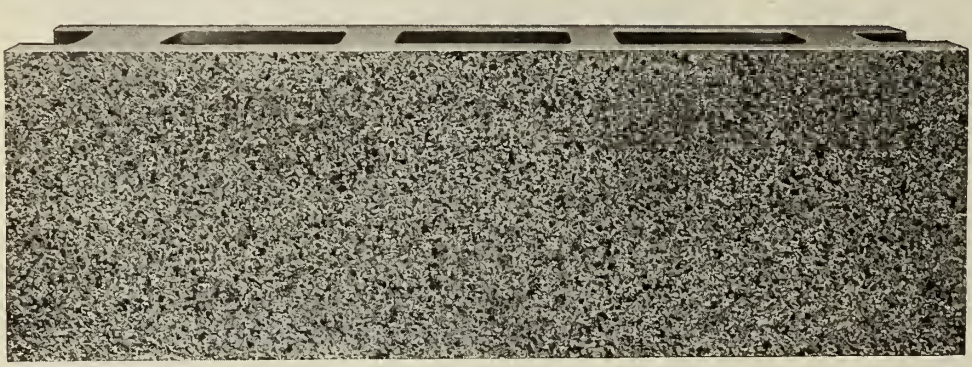

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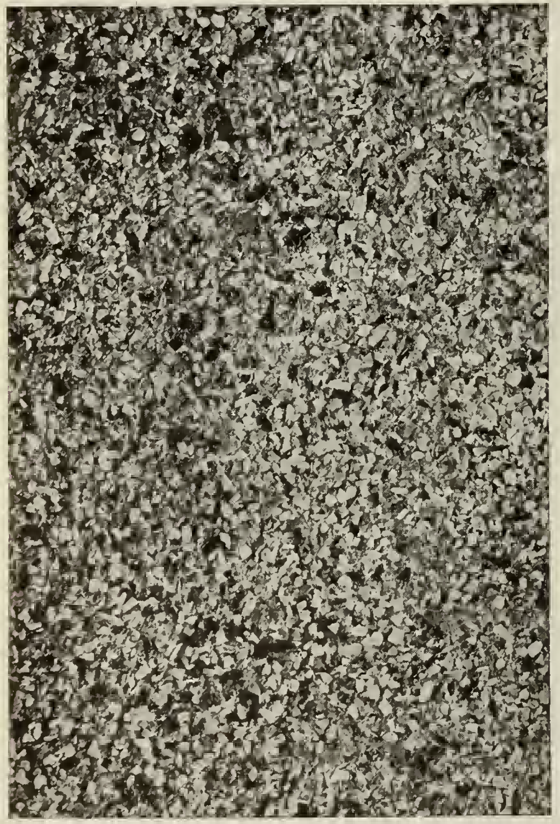

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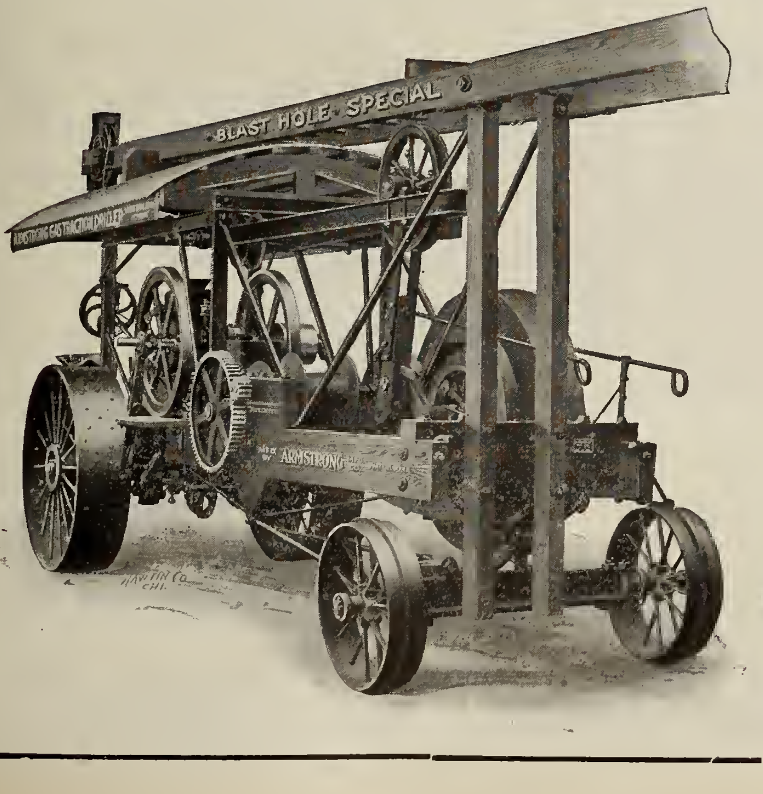

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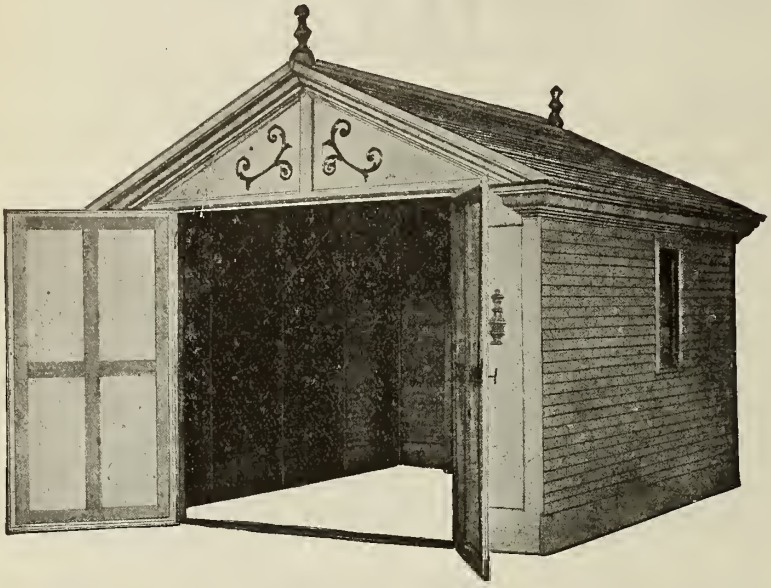

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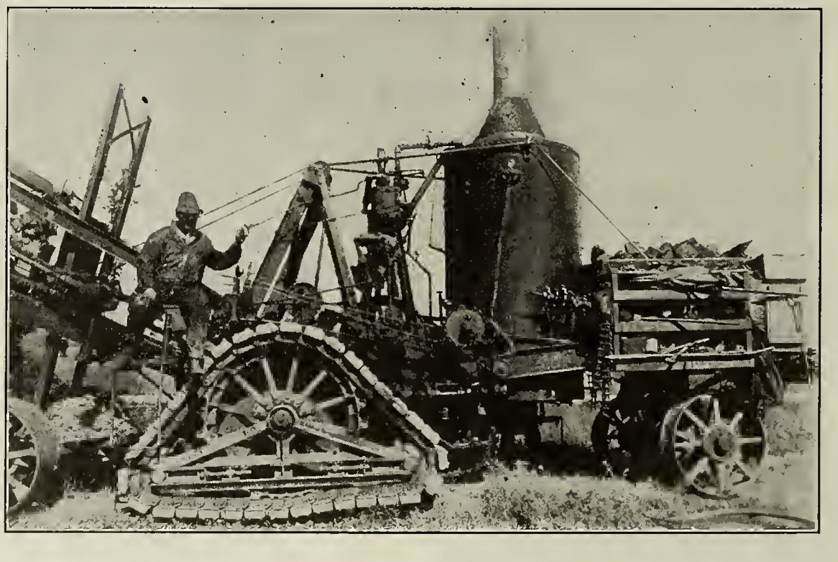

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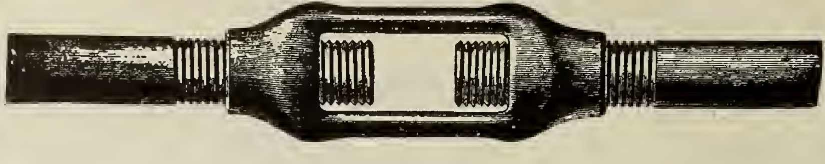

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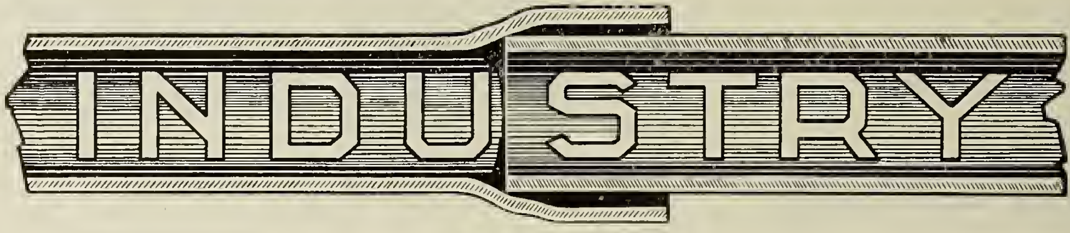

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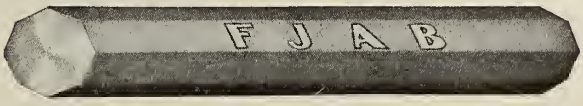

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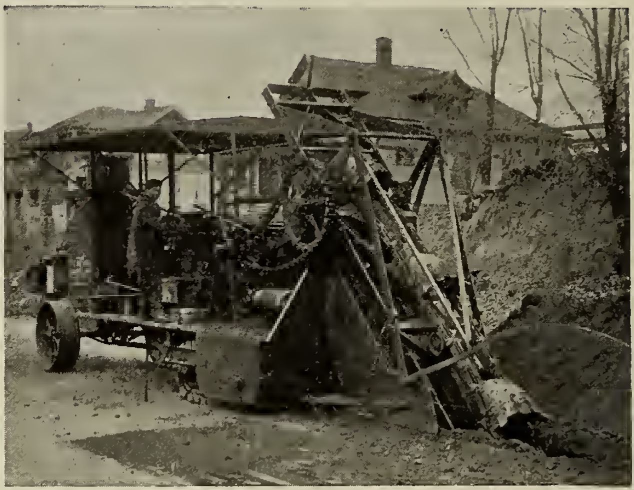

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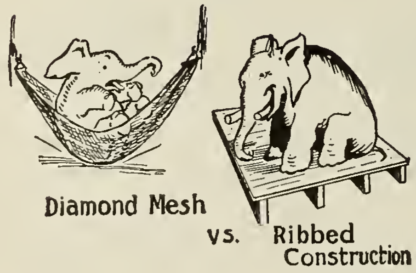

is constructed like a miniature floor. The joists are the ribs and the flooring is the cross filaments.

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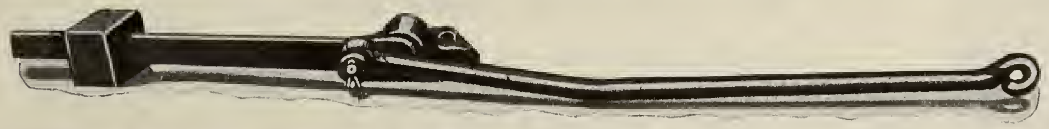
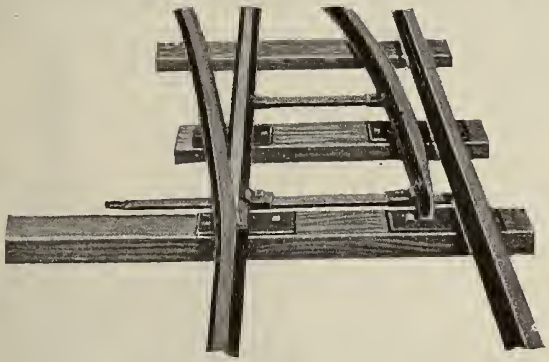


Standard Ground Throw



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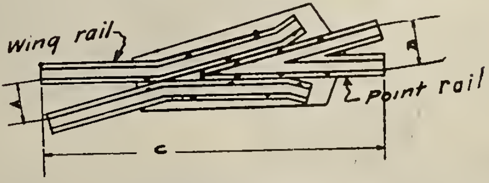

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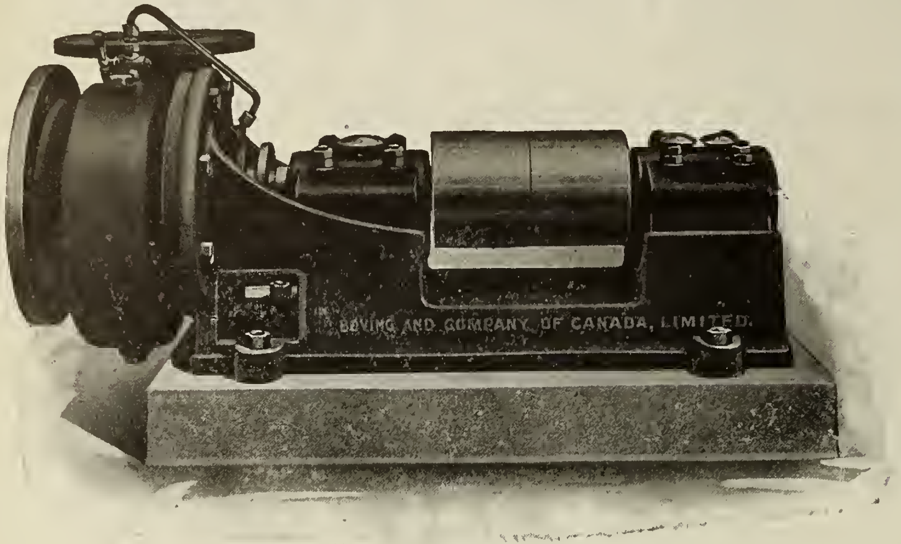

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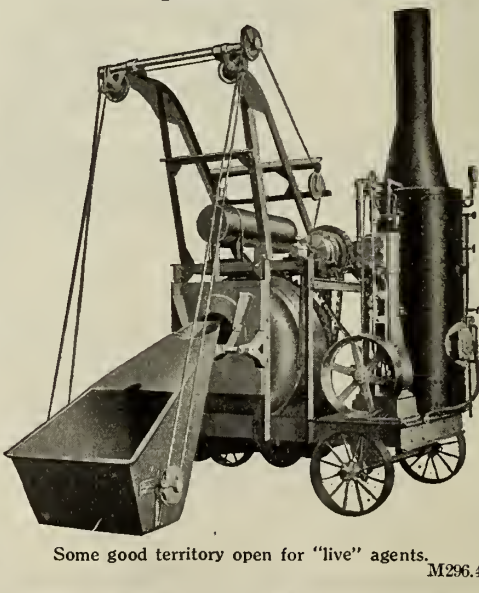

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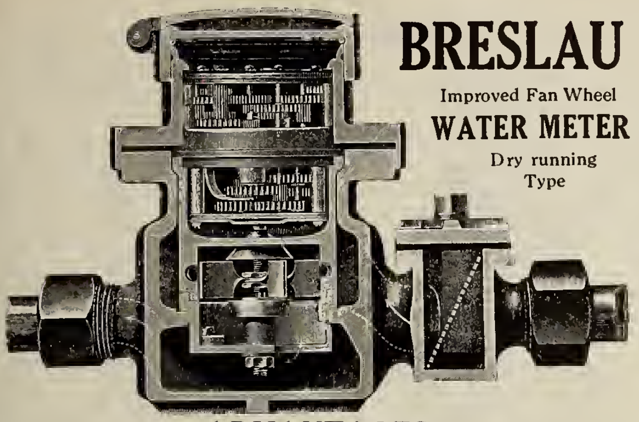

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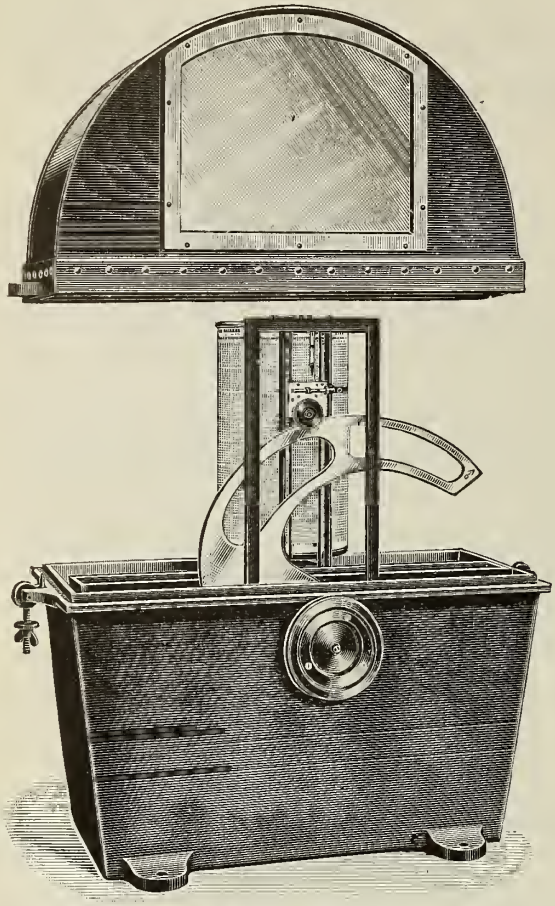

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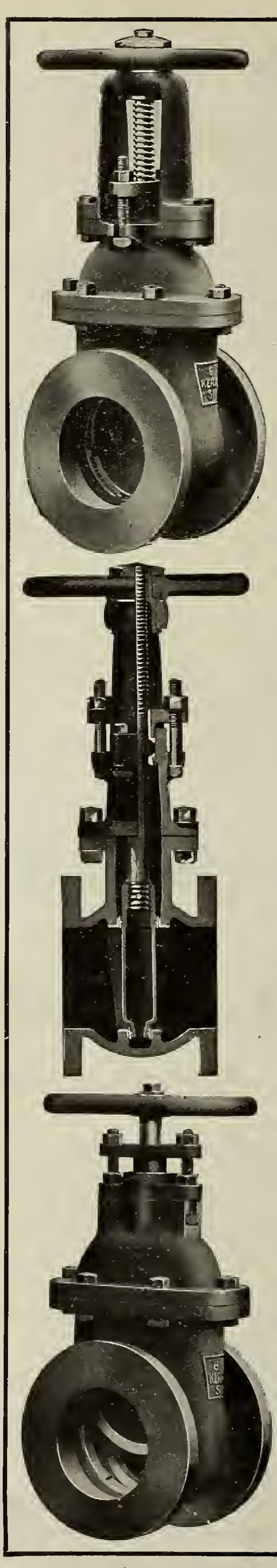

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They have been designed and are built to meet the specifications of the most exacting and critical Engineers, and will bear the rigid scrutiny of "THE MAN WHO KNOWS."

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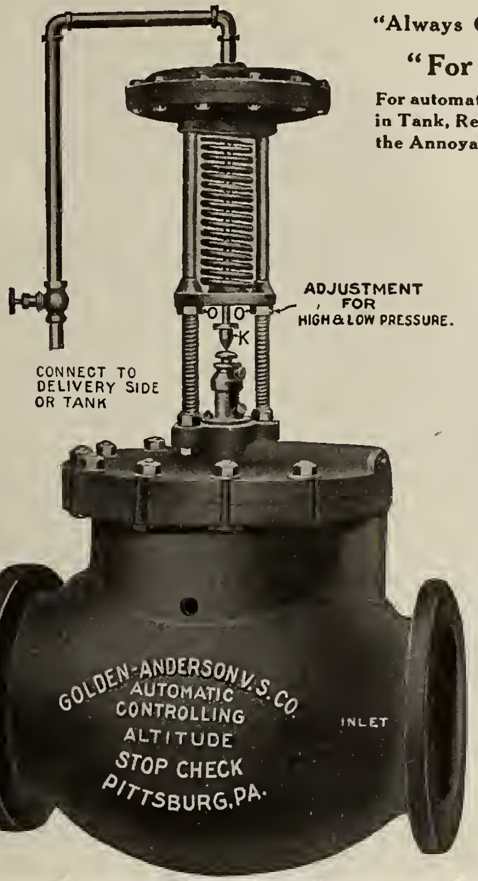

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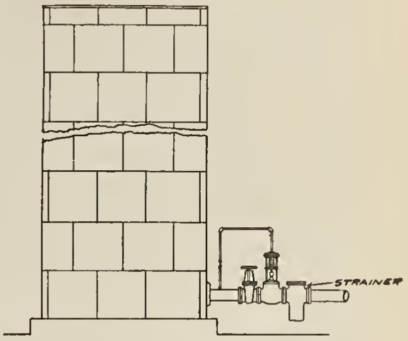

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Made in both dry pressed and impervious.

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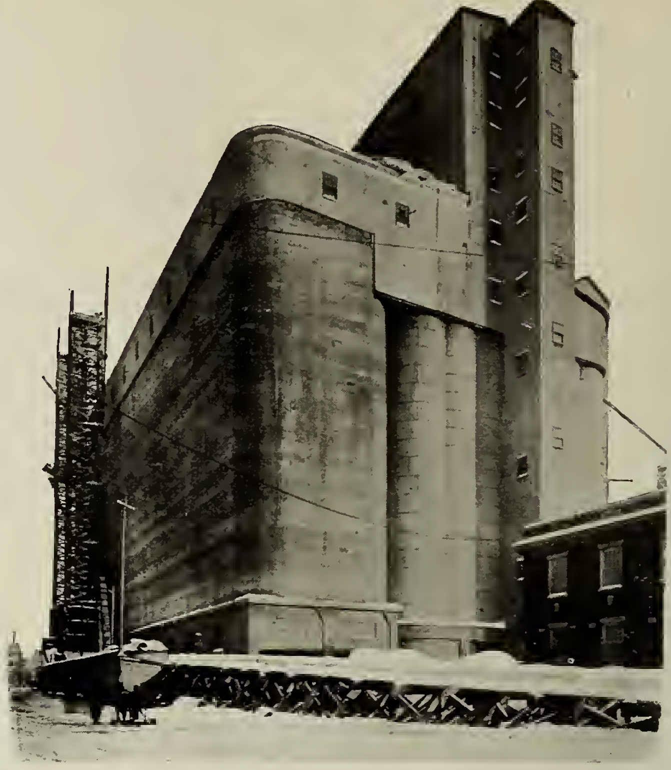

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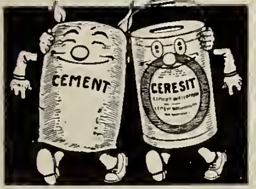

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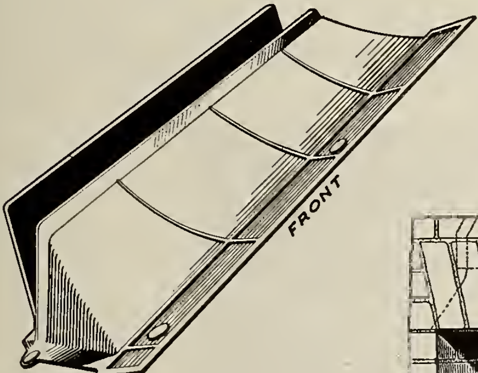

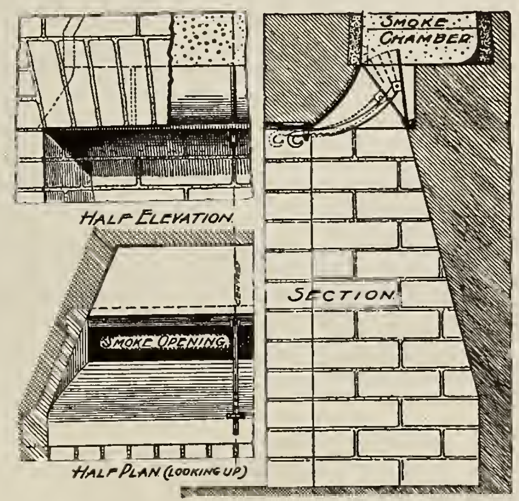

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The original dry white powder waterproofing. Infinitely superior to other powders and to all liquids, pastes, etc. The proportion of actual waterproofing substance in Medusa is very large, and results are both certain and permanent. It is absolutely insoluble and unaffected by water even after years of contact.
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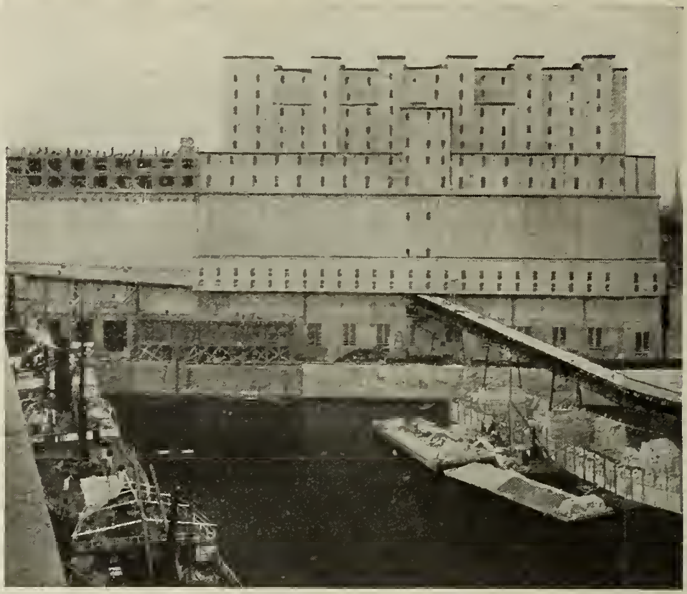

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ESTABLISHED 1886

Contract Record and Engineering Review

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A Canadian Town-Planning Revival

In a day when town planning and civic improvement generally are receiving such specialized study in Europe, it is gratifying to learn that the Dominion Government is awakening to a sense of its responsibilities in this connection, and that Mr. James White, Assistant Chairman of the Conservation Commission, has been sent to England to consult with the town planning experts of the Local Government Board with a view to introducing a better system of town planning in Canada.

With the example of the older countries before us there is no excuse for further bungling, neither can there be any justification for attempting to defer the larger responsibilities. During the last few years a great deal has been written and much more said about town planning and civic improvement schemes, but for the most part the discussions have been "such stuff as dreams are made of." There has been little or no practical work—nothing that can be translated into terms of dollars and cents.

Even in Western Canada, with its rapidly-growing towns which have been cited as examples for the East, the lessons of the older cities have not been learned. Large blocks of land have been held by real estate men and subdivided independently of any town system. The development of these western places is characterized by Mr. White as having a "chequerboard monotony." Such monotony is inimical to the best interests of a people. A community which grows up in the midst of deadly dull similarity grows up without ideals—becomes sordid, depraved.

As for the "great" cities of Eastern Canada, the less said about their planning, or rather lack of planning, the better. It is almost inconceivable that Toronto should have developed into a city approaching half a million people and continued to build upon the lamentable errors and lack of foresight of earlier generations. Except in regard to its natural location and natural advantages, the "Queen City" is a misnomer for Toronto. The narrow streets, the miserable transportation arrangements, the proximity of disreputable tenements to large commercial buildings, the lack of open-air spaces, and the tendency to convert the central portion of the city into gloomy canyons by the erection of "skyscrapers"—all these things are lamentable in the extreme and can be condoned only by those whose lives are concentered in their own personal aggrandisement.

As a people we are too apt to be influenced by the cheap eulogiums handed out to us by American and other tourists. Our cities are not what they seem—are not what they should be.

In opposition to the policy of taking immediate action, it is urged that any thorough reform would require a large loan beyond the borrowing power of Canadian municipalities—at least beyond their power during the present state of financial conditions. But several English towns have shown us by actual experiment that these reforms have cost less money than

TUESDAY MORNING, 10 O'CLOCK—We direct the attention of our readers to a matter of importance. It has reference to the day, and time of day, the Contract Record goes to press. Last week we received a tender advertisement too late for insertion. This meant serious loss to three classes of our readers (to say nothing of ourselves,—the municipality, the dealer and the contractor. The Contract Record goes to press every TUESDAY, and 10 O'CLOCK of that day is the latest we can be sure of getting tender advertisements in. We therefore make a special request that our readers bear this date in mind—TUESDAY, 10 O'CLOCK. Many magazines come out later in the week, but we have always believed that the interests of our constituents are best served by placing the news before them as early in the week as possible. Once more we ask you to bear it in mind—TUESDAY MORNING, 10 O'CLOCK.

has been entailed in maintaining old conditions. As one outstanding example of the truth of this, Mr. White cites the Kingsway, that magnificent modern thoroughfare which runs from Holborn to the Strand, in old London. Here, not only was the street expropriated but the abutting property as well, and when the improvements had been made it was resold at a considerable profit, the returns coming in before the hardship of borrowing had been felt. While we have been discusing the unsurmountable difficulties attendant upon our little problems, London has taken hold of a great task and secured the benefit of increased land value—leaving us pondering still.

Towns such as Hampstead and Port Sunlight in England have met with much success in securing the maximum of air space and avoiding the evil of tenement houses. On the larger scale, London, Paris, Berlin and other cities have undertaken schemes the consummation of which will involve the efforts of generations and the expenditure of millions upon millions.

It is pretty generally known that the newly-formed Town Planning Association of Canada is drafting an Act to be presented to the various provincial legislatures for approval. [It may be of interest to recall Mr. R. O. Wynne-Roberts' criticism of the first draft of this Act, published in our issue of July 1.] Mr. White's report is to be laid before the Conservation Commission in the fall and will serve as the basis of recommendations from that body to the Federal Government. It is to be hoped that it will embody such suggestions, as, put into effect, may tend to compensate for the grievous mistakes of the past.

Contract Procedure—The Deposit Cheque

TENDERING on the construction of some paving work, a Toronto contractor submitted a price $5,000 below the bid of the Works Department and $7,000 lower than that of the next regular contractor. Later he pleaded a mistake in the preparation of his tender, and asked either that the contract should be given to him at the Works Commissioner's price of $46,000 or that his deposit cheque should be refunded. The Board of Control recommended that the deposit cheque should be refunded, and the recommendation was endorsed, despite the unqualified disapproval of the Mayor, who, however, stood alone in his opposition. The Mayor contended that the principle favored by the Board of Control was a vicious one, in that it encouraged collusion among contractors. Was he right?

Crop Reports Encouraging

WE learn that the crop situation in Western Canada never looked better than it does to-day. Perfect weather for seeding, followed by the best of growing weather during the spring months, with plenty of rain coming at just the right time all over the three prairie provinces, has created an atmosphere of jubilant satisfaction among the farmers. This together with the increase of over a million acres in the area under crop in wheat, oats and barley, and the resultant prospects of a bumper crop, forms sufficient basis for the feeling of optimism which prevails among all classes of business as regards the fall trade. This feeling is not confined to any one class of business men, but is most pronounced among those who have the greatest facilities for getting into close touch with the agricultural situation. The building situation in Winnipeg continues to improve, the total building permits for the past six months being within measurable distance of the record year, 1912, and surpassing the total for the similar period of 1913 by over half a million dollars. The totals for the six months ending June 30 last show a valuation of $10,082,400. The first six months of 1913 totalled $9,558,850. In 1912, the biggest year on record for Winnipeg building, June 30 showed a total for the first six months of $11,487,150. For the month of June last, the total value of permits issued was $1,560,200, as against $1,875,800 in 1913. In the building trades, and in contracting generally, there is an ample supply of labor.

Sterilization of Water by Ultra-Violet Rays

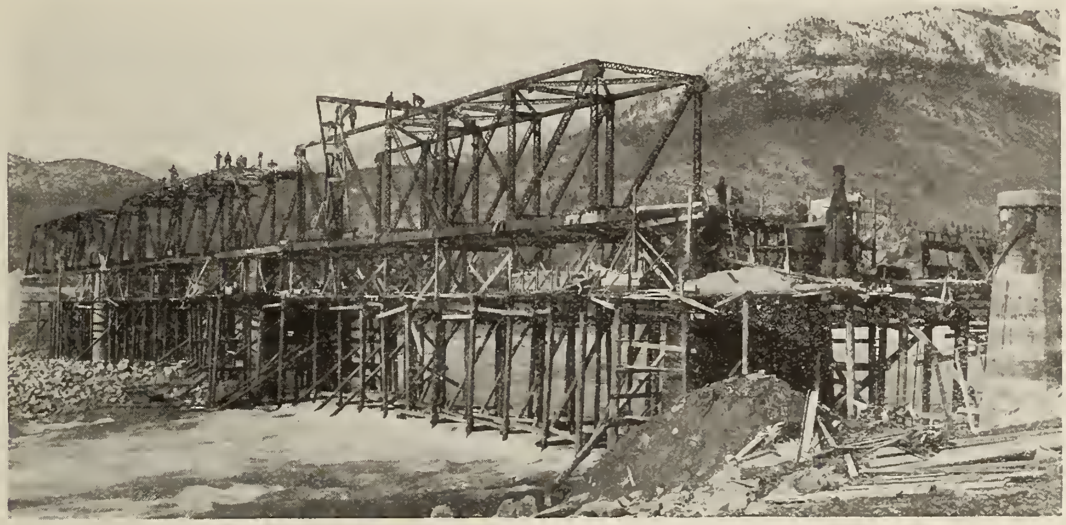
A paper on the sterilization of water by ultra-violet rays of the mercury vapor quartz lamp was given by Mr. von Recklinghausen, Director of the Westinghouse Cooper-Hewitt Company, Paris, France, at the annual Convention of the American Institute of Electrical Engineers held last month in Detroit. It is found that all the dangerous bacteria, and all their spores succumb to the ultra-violet light, if exposed to it strongly enough, for even a fraction of a second. To obtain the use of all the light, the lamp must be surrounded by the water, but it is found that if the water comes in contact with the tube of the lamp itself, the activity is greatly reduced. Also since glass is opaque to the ultra-violet rays, only quartz can be used between the tube and the water. Stirring up the water in its passage through the tank is necessary, to prevent the bacteria from hiding behind particles of the matter in the water and escaping. The largest plant now in use is at Luneville, France, and has ten lamp equipments. The water as fed to this outfit, has a germ content, sometimes as high as 1,000 per c.c.; on leaving, the bacterial content is reduced down to from 0 to 10. There has been a great reduction in the typhoid death rate in this place, the old rate ranging from 70 to 160, balanced against almost no deaths at all, at the present time. The energy consumption is very small; the largest lamp in use takes but 2½ amperes at 500 volts. From 50 to 130 kw.hr. per million gallons is a liberal estimate of the power necessary. In answer to questions which came out in the discussion, Mr. von Recklinghausen estimated the cost at about 80c per million gallons, including power at 1c per kw.hr. and lamp renewals at 30c per million gallons. The water must not be too turbid, so that the light will be too soon absorbed by it. The Luneville plant has been in operation three years, and purifies 200,000 gallons a day.

Covers for sprinkling filters are required at the sewage-treatment plant in Aberdeen, S. Dak., on account of the severity of the winter weather. As described by W. G. Potter in a paper presented at the June 15 meeting of the Western Society of Engineers, concrete piers, 13 ft. apart, were built between the sprinkling nozzles and extended to a height of 6 in. above the surface of the crushed stone to form supports for a wooden framework. On the concrete piers 4 x 4-in. wooden posts were erected with 4 x 6-in. stringers between them. On this framework a temporary winter cover of 2-in. plank is laid. The plank cover only will be removed during the warm season, the framework being left in place, although this framework is so built as to be removable without drawing a nail. This roof is of a flat hip-roof construction, with 3-ft. rise to the center. All wood used on this was painted with a wood preservative before using. The sprinkling filter covers 0.68 acre; with the present normal flow of about 1,500,000 gal. per day it will have a loading of abotu 2,200,000 gal. per day per acre.

Interesting Bridge Work in British Columbia

FINAL operations in connection with the construction of Taghum Bridge, a steel highway structure spanning the Kootenay River at a point about five miles distant from Nelson, B.C., were completed recently by the contractors, Messrs. Hodgson, King & McPhalen Bros., of Vancouver. The bridge was erected for the provincial government after designs by the engineers of the Public Works Department and cost approximately $100,000.

Leading from the north bank of the river, there are three truss spans of one hundred and seventy-four feet, resting on concrete abutments. These are succeeded by two short girder spans of fifty feet, supported on a concrete pier and abutments which form the approach of the south bank. The foundations have been placed in three piers of steel caissons sunk thirty feet below the river bed, the caissons being nine feet in diameter and lined inside with concrete. The width of the bridge roadway is twenty feet and the bridge itself is almost entirely a product of British Columbia, the steel used in its construction having been fabricated in Vancouver, the cement manufactured at Princeton, the lumber grown in this province, and the paint made at Victoria. The approximate amount of materials required included 150 tons of steel for the substructure, 220 tons of steel for the superstructure and 3,000 yards of concrete for the pier and abutments.


Constructional view of the Taghum Bridge over the Kootenay River, near Nelson, B.C.

Aggravating delays were encountered during the preliminary stages of construction on account of repeated failures to erect the false-work in the face of the tremendous current of the Kootenay River at this point. So much time was lost that the contractors were compelled to continually operate three shifts of eight hours each in order to complete the structure before the spring freshets set in. Despite these early reverses and the fact that work progressed for weeks at a time under most severe weather conditions, the bridge was completed in less than seven months from the date of commencing operations and well within the time limit. Construction proceeded from start to finish under the direct supervision of Mr. J. P. Hodgson, A. M. Inst. C. E., and Mr. W. A. McPhalen, members of the Vancouver firm which handled the contract.

Measurements that are difficult to understand should be avoided in planning forms for concrete work. All indications of dimensions should be simple and clear. Avoid wasting lumber, by making as few pieces as possible consistent with the required strength do the work. Avoid too much nailing, for this will make it difficult to knock down without splitting. Make forms strong enough to hold weight of concrete without bulging, for this causes leaks through which water, cement, and sand are lost and the concrete weakened, and also causes surface unevenness that disfigures the job. Besides, when forms lose their shape, it is difficult to use them afterwards. To save on cost of erection and removal, forms should be built in as large sections as are convenient to handle. The most economical wood forms, therefore, are those that strike a happy medium, combining the lightest weight with the largest surface compatible with required strength.

Constructing a filter plant by day labor was one of the features of the new sewage-disposal plant at Aberdeen, S.D. (12,000 population), described by W. G. Potter in a paper read before the Western Society of Engineers. The plant includes a sedimentation tank, sludge filter, siphon chambers, sprinkling filter and final settling basin. The total cost will be about $130,000. Labor was paid 22½c per hour at first, but for most of the work the rate was 25c per hour, and labor was very hard to get during the summer and fall seasons. Carpenters on form work were paid 35c to 45c per hour, and brick masons 70c to 80c per hour. The entire work except part of the excavation, part of the pipe hauling, and the construction of the pump-house superstructure, was done for the city commissioners by city forces, without contract, Mr. Potter being the designing and constructing engineer. He states that it is a good example of non-political municipal work, and that politics was one of the incidental troubles that was entirely absent from this work.

Regulations Governing Plans for Waterworks and Sewerage

THE Bureau of Public Health of the Saskatchewan Government have issued a set of regulations governing the preparation of plans for the installation and extension of waterworks, sewerage and sewage disposal systems. The regulations are the first of the kind issued by any province and the code should be found particularly valuable to municipal engineers. We extract below the instructions proper.

WATERWORKS SYSTEMS AND EXTENSIONS

Regulations

(1) Engineer's Report—

A report shall be submitted prepared by the engineer acting for the municipality giving information under the following heads, in so far as such are applicable to the proposed works.

1. Population—The present population and the rate of increase during each of the last five years; available data justifying a future increase of population and probable increase in next ten years.
2. Maximum population which system will provide for if fully developed.
3. Population provided for by proposed system.
4. Area and topography of municipality.
5. Estimated water consumption per capita per twenty-four hours.
6. Alternative sources of supply (if any) and if investigated.
7. Source of supply recommended.
8. Present available supply of water and how determined.
9. Estimated supply of water under full development.
10. Quality of water.
11. Any present sources of pollution of source of supply.
12. Measures recommended to prevent future pollution of source of supply.
13. Nature and construction of intake or collection works.
14. Wells—The number, depth, size and construction of wells; the nature of the ground through which they are sunk; the construction of collecting galleries.
15. Watercourses—Minimum dry weather flow, approximate watershed area. If continuous winter flow, reduction in available supply during winter.
16. Catchment areas—Approximate area of watershed, character of watershed surface with reference to probable run off, population, arable and stock farming and all available data having reference to rainfall.
17. Natural lakes—Approximate area of watershed, average depth of lake, area of lake, if overflow is continuous, approximate annual overflow, nature of watershed relative to population, arable and stock farming, and all available data having reference to rainfall. Population on shores winter and summer. If surface is used for traffic in winter.
18. The capacities and character of pumps; duplication of machinery and energy.
19. Sedimentation—The size and construction of basins.
20. Filtration—A full description of the proposed plant, including the type of filter, the nature of filtering media, the maximum rate of operation of each unit of the plant; the method of cleansing filtering media; the nature and amount of coagulent or disinfectant estimated to be necessary.
21. Provision for future extensions.
22. Provision for measuring and recording amount of water supplied to municipality.
23. Provision made for storage and capacity of reservoir, stand pipes, etc.
24. Size of force or gravity mains.
25. Distribution system, especially with reference to cut off valves, sluice valves, hydrants and through circulation; minimum size of pipes and minimum depth of trench; character of subsoil.
26. Pressure available for domestic and fire purposes.
27. Particulars as to any provision made for turning water other than the domestic supply into mains for fire protection purposes.
28. Provision to be made for inspection of construction.
29. Control and operation.

In the case of extensions to an existing system, the report shall, in addition to describing the nature of the proposed extensions, deal with as many of the above matters as are thereby affected.

(2) Estimates of Cost—

A statement prepared by the engineer shall be submitted showing the estimated cost of the proposed system or extensions. The estimated cost of all pipe lines shall be shown in schedule form as follows:

Location	Between	Size of pipe	Character of pipe whether steel cast iron etc	No of existing buildings requiring water	Average depth of trench	Length in feet	Cost of pipe laid complete per lin foot	Total cost

The estimated cost of all other sections of the work (e.g., land, intake, headworks, pumps, reservoir, hydrants, valves, etc.) shall be shown separately at the end of the schedule. The estimated operating costs per annum shall also be given.

(3) General Plans—

The following plans shall be submitted:

(a) Plan of Municipality.

A general plan of the entire municipality to a scale of not greater than 200 and not less than 500 feet to an inch. This plan shall show:

1. The municipal boundary.
2. All streets existing or proposed.
3. The approximate location of all habitable buildings not served with water at the date of application.
4. The surface elevations at all existing or proposed street insersections.
5. The elevation of the highest point in the municipality.
6. The location and size of all existing and proposed water mains.
7. The location of stand pipes, valves, hydrants and all appurtenances.

(b) Location Plan.

A plan to a suitable scale showing the site of the municipality, any outside territory affected, and the following:

1. The source of supply, intakes, wells, filters, pumps, reservoir and any special features.
2. The route of gravity or force mains.
3. The following elevations shall be shown:

(a) The low, mean and high water levels of the watercourse or lake at the intake.

(b) The highest known flood elevation of the watercourse or lake.

(c) Surface and water elevations at standpipes, reservoirs and principal points in the system.

(d) Surface elevations showing any irregularities of route with reference to the hydraulic gradient.

This plan is not required in the case of extensions to a distribution system.

(4) Analysis of proposed Source of Supply—

A sample of the water from the proposed source of supply shall be taken not more than six weeks previous to the date on which application is made to the Commissioner of Public Health for his certificate of approval. The sample shall be subjected to chemical analysis and bacteriological examination. A copy of the result of such analysis shall be submitted to the Commissioner of Public Health. The commissioner may require any number of samples extending over a stated period of time, if necessary.

The above shall also apply to each application for approval of extensions to an existing system, the sample being taken from the existing mains, should there be no proposed change in the source of supply.

(5) Affidavit Covering Section (4)—

An affidavit shall accompany any report of water analysis stating that the report of analysis and examination submitted is a true copy of the report supplied by the analyst, and that the water analyzed and examined was taken from the proposed source of supply. The date on which any sample was taken shall also be stated in the affidavit.

(6) Detail Drawings—

Detail drawings shall be submitted to a scale which shall clearly indicate the design of all sections of the proposed system or extensions, including all wells, collecting galleries, intakes, filters, settling basins, reservoirs, conduits, standpipes, siphons, blowoffs, pumps, machinery buildings and other appurtenances.

Profile—In the case of a gravity supply, a profile of the route of the pipe line shall be submitted, showing surface elevations, the hydraulic gradient of pipe line, and air and sluice valves.

(7) Specifications—

Specifications shall be submitted covering all work to be undertaken in the proposed system or extensions.

(8) Affidavits Covering Sections (6) and (7)—

All drawings and specifications submitted under sections (6) and (7) shall be accompanied by affidavits stating that the drawings and specifications so submitted are those to be used and followed in the construction of the proposed system or extensions.

SANITARY SEWERAGE SYSTEMS AND EXTENSIONS

Regulations

(1) Engineer's Report—

A report shall be submitted, prepared by the engineer acting for the municipality, giving information under the following heads, in so far as such are applicable to the proposed works.

1. Population—The present population and the rate of increase during each of the past five years. Available data justifying a future increase of population and probable increase in next ten years.
2. Maximum population which system will provide for if fully developed.
3. Population provided for by proposed works.
4. Area and topography of municipality.
5. Water consumption in municipality per capita per 24 hours.
6. The character of the sewage (with reference to surface and roof water, trade wastes, etc.)
7. Estimated maximum rate of flow expressed in gallons per hour.
8. Estimated normal dry weather flow expressed in gallons per 24 hours.
9. The general nature of subsoil throughout the municipality.
10. Precautions to prevent infiltration in water-bearing strata.
11. The minimum grades of all sizes of sewers.
12. Provision made for flushing and the intervals of flushing.
13. Character of pipes and joints to be used.
14. Type of sewage lifts to be adopted.
15. The maximum distance between manholes.
16. Ventilation of system.
17. Storm overflow discharges and any points of discharge other than the sewage disposal plant.
18. The areas of the municipality which cannot drain by gravity into proposed system. The proposed method of providing drainage for such areas in the future.
19. Provision to be made for inspection of construction.
20. Control and operation.

In the case of extensions to an existing system, the report shall, in addition to describing the nature of the proposed extensions, deal with as many of the above matters as are thereby affected.

(2) Estimates of Cost—

A statement, prepared by the engineer, shall be submitted showing the estimated cost of the proposed system or extensions. The estimated cost of all pipe lines shall be shown in schedule form as follows:

Location	Between	Size of pipe	Character of pipe whether fire-clay, concrete, etc.	No. of existing buildings requiring drainage	Average depth of trench	Grade %	Length in feet	Cost of pipe laid complete per lin. ft.	Total cost

The estimated cost of all other sections of the work (e.g., manholes, inspection chambers, sewage lifts, etc.) shall also be given.

(3) General Plans—

The following plans shall be submitted:

(a) **Plan of Municipality.**

A general plan of the entire municipality to a scale of not greater than 200 and not less than 500 feet to an inch, this plan shall show:

1. Municipal boundary.
2. All streets existing or proposed.
3. The approximate location of all habitable buildings not connected with sewers at the date of application.
4. The surface elevations of all existing or proposed street intersections.
5. The location, size and direction of flow of all existing and proposed sewers.
6. The location of all existing and proposed manholes, lampholes, flush tanks, sewage lifts, sewer outlets, overflows and other appurtenances.
7. Any areas from which it is proposed to pump the sewage; these should be indicated by light coloring or shading.

(b) **Contour Plan.**

A contour plan of the municipality to a suitable scale.

(4) Detail Drawings—

Detail drawings shall be submitted to a scale which shall clearly indicate the design of all parts of the proposed system or extensions, including all manholes, lampholes, flush tanks, siphons, pump wells, inspection chambers, buildings, iron work, machinery and other appurtenances. Transverse sections of all sewers over 24 inches in diameter shall be submitted.

Profiles—

Profiles of all sanitary sewers shall be submitted. The following scales are suggested for general adoption:

Vertical 10 feet to an inch
or 20 feet to an inch
Horizontal 80 feet to an inch
or 100 feet to an inch
or 200 feet to an inch

Profiles shall show all manholes, lampholes, flushtanks, siphons, river and railway crossings, the size and grade of sewers, the elevation of sewer invert and ground surface at all manholes and changes of grade; elevation of river or stream beds crossing the line of sewers.

(5) Specifications—

Specifications shall be submitted covering all work to be undertaken in the proposed system or extensions.

(6) Affidavits Covering Sections (4) and (5)—

All drawings and specifications submitted under sections (4) and (5) shall be accompanied by affidavits stating that the drawings and specifications so submitted are those to be used and followed in the construction of the proposed system or extensions.

STORM SEWERAGE SYSTEMS AND EXTENSIONS

Regulations

(1) Engineer's Report—

A report shall be submitted, prepared by the engineer acting for the municipality, giving information under the following heads, in so far as such are applicable to the proposed works.

1. Precipitation—All available data having reference to the maximum precipitation in the municipality, particularly with reference to short periods of heavy precipitation.
2. Nature of ground surface—The areas paved and unpaved, and in the case of the latter, the degree of porosity of the ground.
3. The area and mean slope of each district draining to a trunk sewer or point of discharge.
4. The data and assumptions upon which the computation of the size of sewers is based.
5. The estimated maximum volume of flow (in cubic feet per second) at each point of discharge, and the estimated increase when the system is fully developed.
6. The character of pipes and points to be used.
7. The nature of coating (if any) to be used on the outside of pipes.
8. Any connections which it is proposed to make with the sewers, other than for surface water.
9. Provision to be made for inspection of construction.
10. Control and operation.

In the case of extensions to an existing system, the report shall, in addition to describing the nature of the proposed extensions, deal with as many of the above matters as are thereby affected.

(2) Estimates of Cost—

A statement, prepared by the engineer, shall be submitted showing the estimated cost of the proposed system or extensions. The estimated cost of all pipe lines shall be shown in schedule form as follows:

Location	Between	Size of pipe	Character of pipe whether fireclay, concrete, etc	Average depth of trench	Grade %	Length in feet	Cost of pipe laid complete per lin. ft.	Total cost

The estimated cost of all other sections of the work (e.g., manholes, catch basins, etc.) shall be shown separately at the end of the schedule. The estimated cost of operation per annum shall also be given.

(3) General Plans—

A general plan of the entire municipality shall be submitted to a scale of not greater than 200 and not less than 500 feet to an inch; this plan shall show:

1. Municipal boundary.
2. All streets existing or proposed.
3. The surface elevations of all existing and proposed street intersections.
4. The location, size and direction of flow of all existing and proposed storm sewers.
5. The location of all existing and proposed manholes, catch basins and connections to the storm sewerage system, also all points of discharge and natural watercourses.
6. The extent of street paving.
7. The areas draining to each trunk sewer or point of discharge (these may be shown by distinctive coloring or shading).

(4) Detail Drawings—

Detail drawings shall be submitted to a scale which shall clearly indicate the design of all parts of the proposed system or extensions, including all manholes, catch basins, valves, etc. Transverse sections of all sewers over twenty-four inches in diameter shall be submitted.

(5) Specifications—

Specifications shall be submitted covering all work to be undertaken in the proposed system or extensions.

(6) Affidavits covering Sections (3), (4) and (5)—

All plans, drawings and specifications submitted under sections (3), (4) and (5) shall be accompanied by affidavits stating that the plans, drawings and specifications so submitted are those to be used and followed in the construction of the proposed system or extensions.

SEWAGE DISPOSAL WORKS AND EXTENSIONS

Regulations

(1) Engineer's Report—

A report shall be submitted, prepared by the engineer acting for the municipality, giving information under the following heads, in so far as such are applicable to the proposed works:

1. Population—The present population and the rate of increase during each of the past five years. Available data justifying an increase of population and probable increase in next ten years.
2. Maximum population which system will provide for if fully developed.
3. Population provided for by proposed works.
4. Water consumption in municipality per capita per 24 hours.
5. Estimated maximum rate of flow of sewage arriving at works, expressed in gallons per hour,

6. Estimated daily flow of sewage arriving at works.
7. The number of connections already made to sanitary sewerage system.
8. The character of the sewage (with reference to surface and roof water, trade wastes, etc.) Any excess over domestic sewage shall be estimated in gallons per hour under:
    (a) Roof water;
    (b) Surface water;
    (c) Infiltration water;
    (d) Trade waste water.

In the case of trade discharge the character of the waste shall be given.

9. The distance and location in relation to the works of any wells or underground source of water supply. In the case of the final effluent discharging into a watercourse or lake, it shall be stated whether such watercourse or lake is, or eventually becomes, a source of domestic supply or is used for watering cattle.
10. Minimum volume and velocity of stream or river into which the final effiuent will be discharged.
11. Area of land acquired for sewage disposal purposes.
12. Character of subsoil through which sewerage system is laid, with particular reference to the presence of sand.
13. Character of treatment processes to be adopted.
14. Type of sewage lifts to be used at sewage disposal works.
15. Provision for dealing with sewage in the case of failure of sewage lifts.
16. Type of screens and provision for the removal of screenings.
17. Preliminary precipitation of mineral particles—velocity of flow in detritus tanks.
18. Type of sedimentation tanks, capacity and velocity of flow in tanks, inclination of base of tanks.
19. Method of drying sludge and final disposal.
20. Capacity of dosing or siphon chamber.
21. Type of filter beds; character, area and depth of filter media. Rate of filtration. Method of distribution over surface of media.
22. Retention of humus.
23. Disinfection of effluent.
24. Provision against frost.
25. Location of bypasses.
26. Provision for measuring and recording flow of sewage.
27. Future extensions.
28. Provision for grading, surfacing, etc.
29. Control and operation.

In the case of extensions to existing works, the report shall, in addition to describing the nature of the proposed extensions, deal with as many of the above matters as are thereby affected.

(2) Estimates of Cost—

A statement prepared by the engineer shall be submitted showing the estimated cost of the proposed works or extensions. The estimated cost of each section of the work (e.g., land, pipe lines, sedimentation tanks, filter beds, mechanical appliances, buildings, etc.) shall be shown separately. The estimated cost of operation per annum shall also be given.

(3) General Plans—

The following plans shall be submitted:

(a) **Location Plan.**

A location plan to a suitable scale showing:

1. The location of the works in relation to the site of municipality.
2. The route of the main outfall sewer.
3. The layout of the various units of the sewage disposal works, including all drains, pipe lines, etc.
4. The area of land to be utilized for sewage disposal purposes.
5. The lake, watercourse or subsoil, into which the final effluent will be discharged.
6. Elevation of high, mean and low water in watercourse or lake.
7. Highest known flood elevation of watercourse.
8. Elevation of effluent drain at point of discharge and of outfall sewer at entrance to works.

(b) **Sketch Plans.**

Preliminary sketch plans shall be submitted to a scale which shall indicate the type and capacity of the various tanks, filter beds, etc.

The principal elevations and measurements of the various parts of the works shall be indicated on these plans. Such preliminary plans shall give sufficient information to enable the commissioner to arrive at a conclusion as to the efficiency of the proposed processes of treatment and design, and structural details may be omitted therefrom. Sketch plans need not be submitted if the detailed drawings required by section (4) accompany the application.

(4) Detail Drawings—

Detail drawings shall be submitted to a scale which shall clearly indicate the design of all parts of the proposed works. Longitudinal and transverse sections of all tanks and filters shall be shown.

Profiles—

Profiles of all pipe lines and drains shall be submitted drawn to a suitable scale.

(5) Specifications—

Specifications shall be submitted covering all work to be undertaken in the proposed system or extensions.

(6) Affidavits Covering Sections (4) and (5)—

All drawings and specifications submitted under sections (4) and (5) shall be accompanied by affidavits stating that the drawings and specifications so submitted are those to be used and followed in the construction of the proposed works or extensions.

It was announced recently that the Pulsynetic System of Electric Clocks (Messrs. Gent & Company, Limited, Faraday Works, Leicester, Eng.), was to be installed on the "Aquitania" and we are now informed that the behaviour of these clocks on the maiden voyage of the great liner was more than satisfactory. Messrs. Gent & Company report gratifying activity in their electric clock department. Of many important installations now in hand mention may be made of the Allan Line offices at Montreal, the Dominion Bank, Toronto, and the premises of Messrs. Henry Birks & Son, Vancouver. In the Dominion Bank equipment there will be fifty dials, some of these being in marble cases. Orders have been received from South Africa, Australia, Russia, and from many parts of the United Kingdom.

At the annual meeting of the Society for the Promotion of Engineering Education held at Princeton University, the following officers were elected for the ensuing year: President, Anson Marston, Dean of the Division of Engineering, Iowa State College, Ames, Iowa; Vice-Presidents, Henry H. Norris, New York, and C. Russ Richards, Acting Dean of the College of Engineering, University of Illinois, Urbana, Ill.; Secretary, F. L. Bishop, Dean of the School of Engineering, University of Pittsburgh, Pittsburgh, Penn.; Treasurer, William O. Wiley, John Wiley & Sons, New York; members of the council, R. H. Fernald, A. H. Fuller, A. M. Greene, Jr., E. V. Huntington, Vladimir Karapetoff, D. C. Miller, W. M. Riggs. The reports of the various officers showed that the society is in a flourishing condition. The individual membership is now nearly 1,400 and the institutional membership about 50. The council recommended that the 1915 meeting be held in the Middle West.

The Fundamental Principles of Aesthetic Bridge Design

As our bridges are becoming more permanent in character, and as their minor features are becoming standardized, engineers can well afford to give increased attention to the aesthetic design of such structures, says a writer in Engineering and Contracting. The engineer should not consider his problem solved when he has provided a structure which will economically carry the required loads; he should not authorize its construction until he has carefully studied the structure with a view of improving its appearance. In many cases the increased cost of an aesthetic design is relatively very small. The following article, which was abstracted from a paper by Charles Evan Fowler, in Proceedings, Pacific Northwest Society of Engineers, considers some basic principles applicable to the aesthetic design of bridges.

The designing of a bridge is not merely a matter of figuring the stresses, fixing the sizes of members, and making a set of drawings. This may all be completed and a design may result, but the design may be one which is not suitable for the location and is not such as it should be architecturally.

The true design to adopt must come very largely as an inspiration to the designer, who must have the necessary talent or imagination to conceive a bridge that will be the most appropriate and harmonious for a given location, and for the existing or future surroundings.

Discussion of Some Important Bridges

The Tower Bridge in London, considered by many writers to be a monstrosity, was conceived by the engineer Sir John Wolf-Barry to harmonize with the surroundings, and particularly with the old Tower of London in the immediate vicinity. When considered in this light it is an appropriate and harmonious design; the mediaeval towers are monumental and the steelwork graceful.

The great suspension bridges of New York are of the same class and are mostly in harmony with the towering buildings in the adjacent territory. The details, however, have not always been carried out in the proper spirit, the towers of the Roebling Bridge, never having been completed, and are thus lacking as truly monumental or architectural features. The towers of the nearby Manhattan Bridge are too light to harmonize with those of the Roebling Bridge or with the nearby buildings, although considered alone it is a complete and pleasing design. The Williamsburg Bridge is entirely lacking in architectural features, it is out of harmony with the present or probable future surroundings, and is only notable in design by reason of its magnitude and the graceful sweep of its cables.

The great arch at Hell Gate, over East River in New York, is, with its 1,000-ft. span and carefully designed abutment towers, a truly monumental structure, and the abutment towers are well designed and appropriate, the great arch demanding this mass for backing to satisfy the impression of a great thrust properly cared for or resisted.

The Washington Bridge across the Harlem, one of the great bridges of the world, is wonderful in its architectural detail, but is lacking in the great essentials for a work of architecture. The main structure consists of two spans, instead of three, thus giving a pier in the middle; and the approaches are not balanced, thus causing the structure to lack in symmetry. Some of the other designs for this structure, while simple in detail, would have made a much better structure and a more pleasing one, as they possessed the fundamental features that are necessary to any real work of architecture—simplicity, symmetry, harmony and proportion.

This is well illustrated by the Eads Bridge, at St. Louis, with its three great arch spans and appropriate approaches. Although the details of the structure are very simple, it is one of the most pleasing and dignified of the world's bridges.

Governing Considerations

The conception of a design depends upon no rules, but upon the inherent ability of the designer, limited as we shall see hereafter by certain theoretical and practical requirements. There may be conceived a number of designs for a given location of different types, any one of which would be appropriate and beautiful, but the final decision as to which one of these to adopt must be made on the basis of relative cost, the most economical being usually selected. On the other hand the most economical should not always be selected, but the best design architecturally should be adopted, especially where the difference in cost is not very large.

The cost, for example, of a four-span structure for a given crossing might be found to be somewhat less than for a three-span bridge, yet it would be wise from any architectural standpoint to adopt the three-span design. The four-span design would have to be very much cheaper than three spans to call for its adoption. The reason for adopting a three-span design in place of a two-span bridge might, on the other hand, be based entirely on the architectural features, as the cost and risk of the three-span structure might be much the greater.

There are, then, two considerations that govern in making a decision as to what design to adopt for any location—the architectural features and the economy of construction, which latter may well be discussed in full before considering the architecture of bridges, and entirely aside from the aesthetics of the problem.

The loads on the piers for various lengths of spans must first be determined in order that the foundations, abutments, and piers may be designed and the costs determined as factors in the cost of complete structures with different numbers of spans. The load on the pier and the weight of the pier having been determined, the size of the base of the pier may be arrived at by using the formula for the allowable pressure on the foundation bed, as given in the writer's treatise on "Sub-Aqueous Foundations," the character of the foundation bed having been determined previously by careful core borings. Several trials may be necessary before the proper size of a pier is determined, and then careful calculations as to the stability of the pier must be made. Should the size be found deficient, as is often the case with deep trusses, or where bascule or lift spans are employed, then it must be increased in length of base until the maximum allowable stresses and pressures are not exceeded. Then, by means of the cost abutments, piers and spans, the relative costs of various designs may be determined, the weight of the spans being calculated from reliable formulas or from actual stress and section diagrams. The whole process may be somewhat shortened by using the "Ottewell" formula given in the writer's treatise, or that given in "Merriman's" Vol. III. The design of the approaches may be a factor in the relative costs, and in such cases must be included in making the comparisons.

Type of Superstructure and Details of Design

The type and design of the superstructure are such a large factor in its cost that they must be fully decided upon before beginning any of the above investigations, and then all designs can be compared upon a common basis. Where the grade is high above the stream, with plenty of clearance for floods and navigation, deck spans of some type are of course the most economical to employ. Where the bridge is high or where the falsework is expensive for other reasons, it may be best and cheapest to use an arch or a cantilever design. Where very long spans are necessary either the cantilever or suspnesion bridge must be used. Where the clearance for high water or navigation is limited through trusses must be used, although it will often be best to use cantilever spans instead of simple trusses. Through arches or half-through arches may often be employed with good results, both architecturally and economically.

The economical design of the superstructure of a bridge requires careful consideration as to the style of trussing, panel length and truss depths. Longer panels and deeper trusses are more economical for modern heavy loads, but for plate and rivetted lattice girders the depths are usually much less than for regular trusses. The span lengths for cantilever bridges should always be decided by careful mathematical analysis, as well as the lengths of the cantilever arms, suspended spans and depths. The height of towers and the depth of stiffening trusses for suspension bridges must also be carefully analyzed.

The design of movable spans should be carefully considered, not only with regard to first cost, but as to cost of operation and maintenance as well; but one should not get the idea that revolving draw spans are out of date, for in many locations they are the cheapest and the best to employ. Then there are locations where bascule spans are the best from every point of view, but where used they should harmonize with the remainder of the structure if there are additional spans; but in many cases those forms must be abandoned that have no pretensions to architecture or beauty, and the same thing may be said with regard to other types of movable spans.

The details for ordinary spans have reached a practically permanent basis, so that standards, at least as to type, are usual. Where the structure is of unusual size like the Blackwells Island Bridge, the Forth Bridge, or the Hell Gate Arch, each member must be the subject of critical analysis and study. Lack of such study and analysis was the cause of the failure of the first Quebec Bridge. Great suspension bridges are of necessity special problems throughout and must be studied with greater care than any other type.

The floors of railway spans are usually of a standard type, either having steel stringers and ties or a steel trough floor with ties laid on the ballast; but the types of floor and paving for highway bridges are so numerous that it is often a grave quetsion what type to adopt. The cheapest floor that should in any case be used on a good bridge is one having steel joist with spiking strips bolted to them, to which the floor plank is spiked. The very best floor is undoubtedly a reinforced concrete slab, with from 1½ to 2 ins. of sheet asphalt surface, although it may be wise to use a creosoted block surface, the thin blocks being set directly in asphalt on the concrete and filled with sand or grouted.

Having discussed those things which have to do directly with the economy of bridges, with masonry piers and steel superstructures, we may well discuss structures built entirely of stone, of concrete, or of reinforced concrete. Such structures must be fully designed and a careful estimate of cost made in order to make any reliable comparisons. The cost of stone bridges is, of course, the greatest of any type which might be considered, and in the case of the Knoxville Bridge where the cost of the arched cantilever was only $250,000 the bids for the stone arch design were about $1,500,000, thus making it out of the question to use stone where low first cost was a necessity. The same is true to a very great degree with concrete arches, but when reinforced concrete arches are considered, they may be designed to cost but slightly more in many instances than steel bridges, and should be carefully considered where a permanent and artistic structure is demanded.

Basic Principles of Aesthetic Designing

There are, it is true, no orders of architecture for bridges as for buildings, nor is there possible any classification of styles for particular ages, as in the case of building architecture, but drastic rules must be observed, whether the design be for a building or for a bridge.

Simplicity, harmony, symmetry, and proportion must be regarded in any design that would have any pretensions to beauty or to architectural effect. They are the fundamentals of true architecture, no matter what the structure may be to which thought is to be applied in its design.

Simplicity means first a truth telling structure, no subterfuges about the lines of stress, no covering up of a concrete structure with a stone facing, no frivolous or inappropriate details, but a strict adherence to the necessary features, whether they are to carry the loads or to ornament the bridge.

Harmony is essential to a pleasing design, for without it the structure would be distasteful. Harmony not only as between substructure and superstructure, between the various spans, between the spans and the approaches, between the utilitarian features and the ornamental details, but also with the surroundings.

Symmetry may or may not be essential to a pleasing design, although it usually is necessary if a truly architectural structure is to result. Where the bridge has a great length, unsymmetrical features are not so noticeable as in a shorter one which may be all taken in at a glance. As is often true in a landscape, balance may frequently be secured by including unsymmetrical features. For example, in a bridge which contains a draw span or other unbalanced feature, some feature may well be introduced in another part which will tend to restore the balance, even though symmetry does not result.

Proportion is necessary in order that the three preceding principles may be realized; and usually when the economical proportions have been determined, they are pleasing. However, in many cases modifications must be made to reach the point where economy and beauty can both be satisfied. Proportion of details employed for ornamentation is quite another thing, and to be harmonious bridges must have the proper proportion.

Examples may be seen in every structure of the proper application of some of these principles, but more often we find one or the other flagrantly violated, so that the remark of C. Shaler Smith, that Dean of American bridge engineers, to one of his assistants should be well remembered by him who would reach high rank in his profession—"most bridges are examples of what not to do." Seldom if ever do we find a structure that complies with all of the fundamentals, although many bridges approach so nearly to the ideal that careful consideration and analysis is necessary to determine just where improvement could be effected.

Simplicity is best illustrated in its pleasantest features by suspension bridges and arches with no decorations or embellishments of any kind. Harmony is best exhibited where no part of the structure seems to be extraneous, and where the structure seems part of the surroundings. Symmetry in its simplest form is where one-half of the structure is exactly like the other. Proportion is most nearly reached when the structure is most pleasing and the truth expressed most accurately.

The basis for a real architectural system for bridges must come of course from building architecture, and on studying the columned or arched facades of buildings we find an uneven number of openings or arches are employed in the great majority of the world's notable and best pieces of architecture. Where there is an entrance it is nearly always in the centre, with one or more arches symmetrically disposed on each side.

Careful study and analysis of the examples of Egyptian, Roman and mediaeval buildings discloses the fact that such an arrangement is most pleasing to the senses, and where it has been violated the design is unpleasant. This, then, we may take as the starting point of any design, an opening instead of a pier at the centre, with the remainder of the structure arranged symmetrically on each side. Carried to its logical conclusion, where there is an approach it should have an uneven number of openings, and where there are spandrel arches employed in an arch bridge, they should be of an uneven number.

Discussion of Some Existing Bridges

The Knoxville arched cantilever, designed by the writer, was of five main spans and two anchor arms, thus giving an opening at the centre and a perfectly symmetrical structure, except that one abutment was longer than the other, but this is not apparent to the eye in a structure a third of a mile long. Economy was violated in the depth of the anchor spans in order to make the bridge harmonious and the basic rules were all as nearly adhered to as is often the case.

The Market street arch, at Youngstown, Ohio, designed by the writer, was a very difficult problem to solve, both on account of the side spans having to clear the railway tracks and on account of the 4 per cent grade of the roadway. The design, however, is symmetrical with the exception of the grade and the approaches, and it was made quite harmonious by carrying the sub-trussing of the side spans through at the same elevation as the lattice truss over the arch.

Comparing the Memphis Bridge, by Morrison, with the Thebes Bridge, by Modjeski, we can readily see how much is gained in architectural appearance by the symmetrical arrangement of the spans in the Thebes Bridge. Comparing the approaches of the Thebes Bridge with the approaches of the Forth Bridge, we see how much more in harmony with the main structure are the approaches of the Forth Bridge than those of the Thebes Bridge, although considered alone the latter are of the best design architecturally.

The Grosvenor Dee Bridge, at Derby, England, with its 200-ft. masonry span, is one of the great bridges of the world, but the panelling of the abutments and spandrels, and indeed all the decorations, are so out of harmony with the great span that they dwarf it and ruin the design. Compared with similar details of the Eden Park reinforced concrete arch, Cincinnati, Ohio, we find such ornamentation entirely appropriate and harmonious for the smaller span.

European bridges are more often well designed architecturally than those of other countries and the great bridge over the Rhine, at Bonn, Germany, is an example where simplicity, harmony, symmetry and proportion are all as fully met and satisfied as has ever been the case in any bridge structure.

The Camelback Bridge in the Imperial Palace grounds at Pekin, China, is also one of the most perfect of the world's bridges from the architectural point of view and satisfies the cardinal requirements of design.

The best design in the United States, in the writer's opinion, is the Connecticut Avenue Bridge, in Washington, D.C., with its five great concrete arches. Very little fault can be found with the design, except the inappropriate decoration of the wing walls of the abutments. The designing of harmonious and appropriate details in the proper proportion is a study in itself and is entirely beyond the scope of this paper. However, should designers carefully observe the cardinal principles herein laid down much more pleasing structures would result and a great stride forward be made in bridge engineering and architecture.

The necessity for good construction, especially of foundations, must not be overlooked, and no matter how chaste and beautiful the design, it is as nothing if not of first-class engineering and construction.

A rope railway, seventy-five miles in length, is to be put in operation in India. It will connect the rich country in the Vale of Kashmir with the plains of the Punjab over the Himalayas. The line, it is claimed will be the longest in the world, the present longest being 22 miles and situated in Argentina. Sections will be 5 miles long, and most of the spans will be 2,400 ft. The steel towers, some of which will be 100 ft. high will be braced, and double 1½-in. cables, 9 ft. apart, will carry the steel cars. The carrying capacity of these cars will be about 400 lb.

A contemporary points out that in fire after fire it has been demonstrated that unprotected ironwork only helps to destroy buildings "by expanding and pushing out the walls or yielding under the heat and pulling them down." After referring to slow and costly experience of so-called methods of fire-proofing, our contemporary makes the following remarks upon reinforced concrete:—"Whatever may be the opinion of architects as to its adaptability, there is no doubt that its proved fire-resisting and other desirable qualities ought to secure its use for the structural portion of all large buildings. We are afraid, however, that safety alone is not a sufficient inducement to adopt it, and not until architects and capitalists find that it is really an economical method of construction and makes a good foundation for adornment shall we see it as widely used as we think it should be."

Disinfection of Sewage and Its Success in a Small City

By Frank A. Niklrk, Consulting Engineer, San Jose, Cal.

THE College Park sanitary district which lies adjacent to the City of San Jose, Cal., was organized in 1905. The boundaries of the district were extended in 1907 to include Hanchett Park, an exclusive residential district, and now include an area of about 2.6 square miles. At present the population of the district is slightly over 2,000.

As originally constructed, the sewage disposal works consisted of a septic tank and two filter beds. The plant is located on the bank of the Guadalupe Creek, into which the effluent of the filters was conducted. The filters were built in a natural excavation; about two feet of creek gravel was placed in this. The filters were approximately 340 feet long; one was 12 and the other was 15 feet wide.

The beds were not underdrained; for this reason and also the lack of depth of the filtering material, they were never very satisfactory. They were early abandoned and the effluent of the septic tank was discharged directly into the creek.

When water was plentiful in the Guadalupe Creek this effluent was not a nuisance. For the past two years, however, there have been no freshets to cleanse the channel, the growth of vegetation has been very rank and the amount of water flowing in the creek has been far below normal.

Under these conditions, with the water in the Guadalupe containing a relatively low percentage of dissolved oxygen, it can be readily seen that conditions are not very favorable for the disposal of sewage by dilution. The growth of vegetation checks the tendency toward re-aeration, and an unsanitary condition is apt to exist.

Under such circumstances it became necessary to treat the effluent of the septic tank before discharging it into the creek, therefore a temporary plant for treatment with chloride of lime was installed while the present plant was being constructed.

A treatment plant of this type requires a supply of water with which to mix the chloride of lime; consequently a windmill and tank were constructed over a well that existed at the end of the septic tank. The hypochlorite apparatus was located in the tank frame, which was inclosed to protect the plant from outside interference, as a constant and uniform action is required.

The apparatus consists of a mixing tank and two storage tanks, each holding about 275 gallons, and a fourth tank, in which are located the devices for regulating the flow. The tanks are arranged so that the flow is by gravity throughout the entire plant. Each tank is provided with an outlet through which to draw the solids that settle out of the solution.

The chloride of lime is put into the mixing tank and the tank filled with water. During the filling the solution is thoroughly mixed. The stirring device consists of a sort of propeller on a shaft, suspended from the top of the mixing tank. The shaft is revolved by a ratchet device operated by moving a lever backward and forward.

After mixing, the solution is allowed to stand sufficiently long to let the greater portion of the suspended matter settle. The clear liquid is then drawn off into the storage tanks through an outlet six inches above the bottom, so as not to disturb the settled solids. More water is then turned into the mixing tank and the insoluble residue is stirred up and flushed into the outlet sewer. The operation is then repeated.

At the College Park plant three "batches" are mixed each morning for a twenty-four hour run. The third "batch" is drawn slowly from the mixing tank and into the storage tanks as the latter are being emptied. This method was adopted in order to use the maximum quantity of water, the greater flow being more easily regulated.

In small installations, irregular flow of the solution is common, due to the clogging of the measuring orifice by imperfectly settled solutions, or by flakes of calcium carbonate being formed in the solution tank by the absorption of carbon dioxide from the air.

In this particular installation the solution flows from the storage tanks to the regulation tank and is controlled by a float valve which keeps the liquid in the latter at a constant height. In the regulation tank is a half-inch brass tube extending from above the surface of the liquid down through a large rubber stopper in the bottom of the tank. In the side of the tube is a three-sixteenth-inch hole which admits the solution. The rate of flow depends upon the head of water upon the orifice, and the desired rate may be obtained by raising or lowering the tube through the rubber stopper in the bottom of the tank.

From this tank the solution is carried through a four-inch vitrified pipe line to the outfall sewer, where it mixes with the effluent of the septic tank.

The sterilizing action of chloride of lime is very ably set forth by Professor Charles Gilman Hyde in a paper presented before the fourteenth annual convention of the League of California Municipalities at Santa Barbara in 1911 and entitled, "The Sterilization of Water Supplies by the Use of Hypochlorites." While Professor Hyde's paper refers particularly to the protection of water supplies, the action of hypochlorites is analogous in the purification of water supplies and sewage effluents. In both cases hypochlorous acid is formed, which gives up its oxygen in the presence of organic matter.

In designing disinfecting apparatus one of the important factors to be dealt with is the fact that calcium hypochlorite exerts a very strong corrosive action upon wood and most metals. In some cases the tanks are lined with cement mortar laid on metal lath; in others a resistant paint is used. The pipes should be well galvanized and the valves should be bronze. The plant should be well ventilated, as the dust arising when the drums of chloride are opened, and during the making of the solution, is very irritating to the eyes and the membranes of the head.

Hanging walls of Imhoff tanks in a small installation near Chicago were constructed in sections on the flat, outside of the tank and the wire reinforcement left sticking out of the ends to secure it when placed in proper position, according to L. K. Sherman in discussing a recent paper before the Western Society of Engineers by W. G. Potter on the "Sewage Disposal Plant at Aberdeen, S.D."

Sewage Disposal for the Country Home

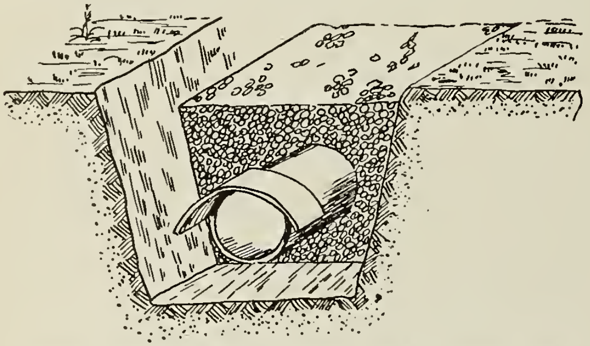
How to Build of Brick and Vitrified Sewer Pipe a Simple and Most Efficient Plant

By Benjamin Brooks

IN some respects the cities are healthier than the country. I read Thoreau and other nature literature, and like it; but all the same it is upon going to the country for a vacation, not upon returning to the city, that I submit to having myself punctured by Dr. Watson's needle full of typhoid-preventive.

The reason the cities are ahead of the farmers on sanitation is because they have had to be. Problems of sewage disposal overcome by cities generations ago, are now confronting the farmer for the first time. Sewage disposal on the farm was formerly carried on largely through the back kitchen window.

Five years ago a city firm was greatly astonished to receive an order from a remote but prosperous farmer for a first-class porcelain bathtub and "fittings." The firm wrote back, asking him if he didn't mean an enamelled tub, advising him of the high cost of the porcelain article. The farmer answered immediately to the effect that he knew what the proper stuff for a bathtub was, that he had the money to pay for it; also, that he was as good as any city dweller and was going to have what he wanted.


Method of surrounding the vitrified sewer pipe with broken stones.

A great many farmers have since come to the same conclusion. Their wives have read the hot-and-cold water advertisements in various magazines and their daughters have just returned from college.

The inevitable result is a gasoline-driven pump at the well instead of a bucket on a rope, a complete piping system upstairs and down instead of a barrel on the back porch, and a fully equipped bathroom that uses up more than a hundred gallons of water per day for each member of the household.

But now comes the farmer's real problem—how to get rid of the hundred gallons per. In summer the old sump hole down in the corner of the lot is overflowing to the vegetable garden and the duck pond. The flies are "just awful," the atmosphere is also "just awful." Typhoid threatens. The farmer must have a sewage disposal plant.

Sewage always contains a multitude of bacteria. Certain kinds of these decompose garbage into its original elements. But these little workers to operate to advantage must have certain conditions. These conditions are to be found in sewage disposal plants, which are constructed in such a way as to meet this need. Among the farmers they are becoming more common. A sewage disposal plant, then, is nothing but a "bug farm;" but it must be remembered that the "bugs" are exceedingly fussy. Some must live in water without air. They prefer quiet neighborhoods and resent disturbances. You see now why the old-fashioned sump is not a suitable bacteria farm.

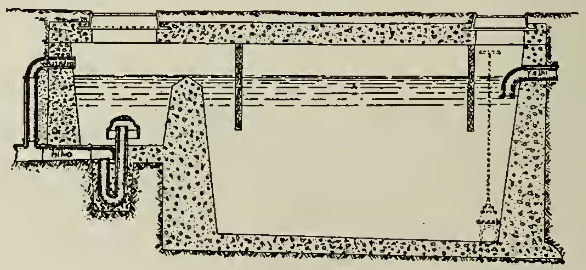
The first stage of a farm sewage disposal plant is a settling tank sunk in the earth. For a family of four, it should be about five feet deep, four feet long, and three feet wide. The inlet pipe from the house should enter it at a grade of about three inches to a hundred feet and turn down under water to prevent splashing. A baffle board in front of it will also prevent disturbance in the tank; and the industrious bacteria, although experiencing much inconvenience due to changes of environment and sudden inrushes, will manage to dissolve and disintegrate a part of the putrescible matter. Meanwhile the stray dish rags, hair pins, or other obstructions will tend to sink quietly to the bottom.

The sewage then passes under another baffle, over the end wall at the far end of the settling tank, and so into a discharge chamber with a siphon at the bottom. The sewage having risen to the proper level, the siphon—just a plain flush tank siphon always to be had in the market—automatically empties the discharge chamber.

The ideal home for aerobic bacteria or "fresh air bugs" is a pile of loose stones flooded from time to time with rich and delectable sewage. We have, therefore, but to lay a line of three-inch vitrified clay sewer pipe in an open trench leading away from the settling tank and then fill the trench around it with broken stone about the size of a pigeon's egg.

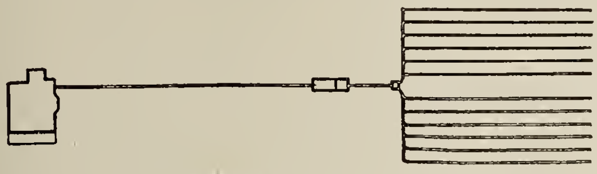
In order to allow for possible repairs, lay two lines of vitrified clay sewer pipe in two rock trenches each about one hundred feet long. The pipe is not porous, of course, for then the winter frosts would burst it, and plenty of room must be left at the joints for sewage to leak out into the rock trench.

All the materials for a sewage disposal plant, in fact, must be of the best on account of the strong chemical nature of sewage. Tanks should be built of excellent brick set in rich cement so "slushy" that the joints cannot be entered by the point of a trowel. The brick themselves are acid proof. Where concrete has to be used, it must be of the best, with a carefully trowelled surface, for such concrete as is ordinarily used for water culverts or sidewalks is soon destroyed by sewer gas. Metals should be used sparingly for they are all sure to corrode rapidly.


Cross section of small settling tank with intermittent discharge siphon.

Having thus been provided with model housekeeping apartments, the aerobic family are quick to move in. During the flooding of their dwellings they may be figuratively, said to stock their pantries and to eat greedily.

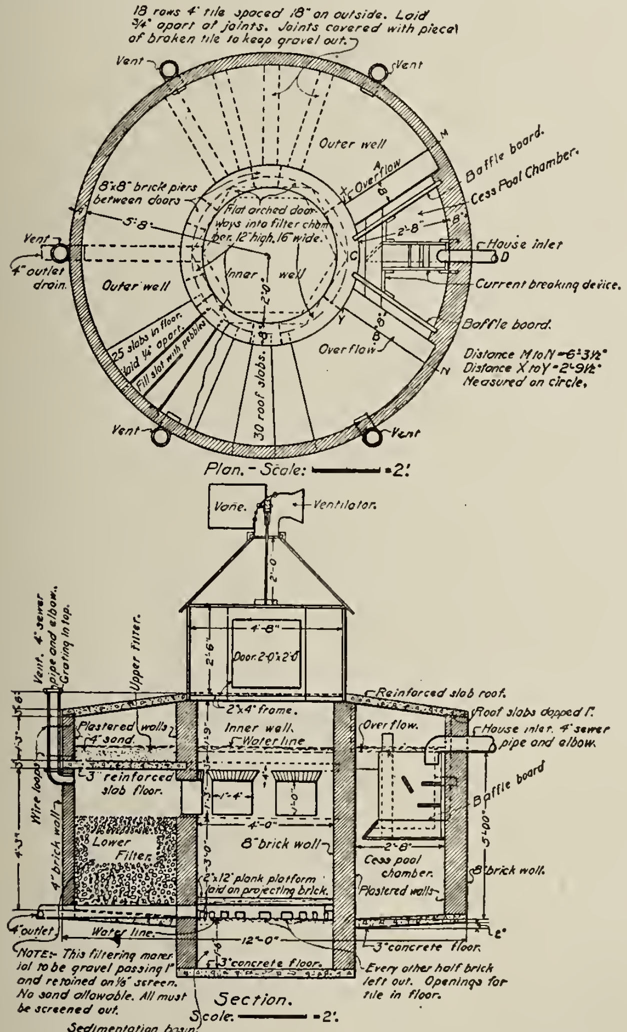
Now, of course, there are many modifications of this simple lay-out. The tank, for instance, can have a sort of double bottom with a slot in the upper one to let down the settling solids, and a sluice gate in the lower one to sluice out the sediment every few months.



Ground plan showing relative position of house with settling tank of brick and distributing tiling.

If the ground slopes sufficiently and the amount of sewage permits, liquid can be sprayed continuously over the rock trenches instead of flooding them intermittently—in which case there is no need of the flush-tank siphon in the settling tank.

Again, if the soil is very porous and sandy, we do not need broken stone, but may simply bury the clay pipe in the soil. The finer the gravel, the purer the water coming from the disposal plant, but the more liable is the kitchen grease to clog up the whole system.



Ground plan and vertical section of circular tank 16 ft. in diameter.

Since no settling tank is perfect and no siphon is absolutely proof against clogging, and no stone trench entirely proof against freezing, there has been evolved a very compact and efficient disposal plant all in a nutshell, with neither siphons, valves nor exposed beds. It gives great promise of success.

This plant, shown in the illustrations, consists of a circular tank sixteen feet in diameter, sunk in the ground, with another smaller circular tank inside it. The large outside tank is a shallow two-storey affair, while the inside one is a deep well. Sewage flows into a settling pocket on one side, and having overflowed this, streams out over the second story, making a shallow lake for the pleasure of the anaerobic or sea-going bugs. It then strains through a bed of coarse sand, drips through holes in the floor, and rains down on the fresh air cranks that live in the broken stone down stairs. Having been shorn of all its objectionable features by these voracious ones, it trickles down to the bottom of the central well and then flows harmlessly away. Ventilators, meanwhile, cause fresh air to stream through the tank.

From all this it appears that a sewage disposal plant on the farm is a matter of careful planning and attention to certain necessary details but simple in construction, cheap in cost and can be built by any farmer who wants to do it.

Fire-Retardent Paint for Shingles

One of the many interesting papers read at the annual convention of the Master Painters and Decorators' Association of Pennsylvania held recently in Pittsburgh, was that on the above subject by Henry A. Gardner of the Institute of Industrial Research, Washington, D.C. The paper was of considerable length and dealt with many phases of the subject, including a description of a series of laboratory tests to determine the heat deflecting properties of various types of roofing materials. Miniature houses were roofed with bare shingles, painted shingles, tin and stone. These houses were placed in an oven heated to 150 degrees Centigrade. At the end of 15 minutes thermometric readings were taken and the interior of the houses roofed with stone and tin showed a much higher temperature than those roofed with shingles. The house with the roof covered with painted shingles showed the lowest temperature. On account of the heat deflecting properties of shingles they will probably always find a wide application in warm climates, and the point was also made that shingled dwellings are much cooler in summer than ironclad or stone roofed dwellings.

A summary of the conclusions reached were given as follows:

The shingled roof is highly desirable on account of its durability, light weight, low cost and non-conducting properties.

Shingled roofs are subject to conflagration when they become dry. Hot cinders from chimneys or glowing sparks carried by the wind from nearby fires are common causes of roof fires.

The use of high-grade mineral paints upon shingled roofs eliminates such fire danger. Shingled structures of all types, when properly painted, are not only fire resistant but they are moisture proof and highly ornamental.

The painted shingle dwelling constitutes one of the most desirable types of modern suburban homes.

As a man remains in the employ of a firm, states the American Machinist, so his particular skill on his job increases. This skill does not represent an item of cost to the firm, but it does represent an asset; his skill and knowledge are direct money value to the shop where he is employed, and his departure diminishes the capital of the firm by that amount.

Management Engineering Applied to a Highway Contractor's Organization

By Henry B. Drowne*

THE fact that highway construction work looks simple and that only a relatively small amount of capital is required has led a large number of people to enter the field of highway contracting. Of this number some make a success, while others are a complete failure. Unfortunately the law of the "survival of the fittest" does not always apply, because there are instances of those who survive through the medium of dishonest work. Competition in this line of work is very close. The big contractor with large plant equipment and heavy overload charges must meet the competition of the small contractor who has plant enough to work only one job at a time and probably personally superintends the work. There is another class of contractors who make competition particularly discouraging at times by ignorantly bidding work at figures all out of proportion to the actual cost. This last class, however, is rapidly eliminated after trying to do work for which the bids have been too low. On account of the above conditions a contractor, who operates on a large scale, must have a sound system of management or otherwise he will be forced out of business.

The writer believes that any man or association of men who desires to enter the field of contracting should first incorporate, as there are several advantages gained thereby. An incorporated company would usually have as officers a president, vice-president, treasurer, secretary and general manager. There might be a man for each office or one man might occupy several of them, depending upon the size of the corporation.

No attempt will be made to outline in detail the duties of the individual officers of the corporation. Suffice it to say that at this point there should be two main divisions of duties into what might be called office work and field work. The office work would include all financial transactions of the company, such as obtaining credit, purchasing bonds, insurance, machinery and supplies and all accounting incident to the performance of the business of the company. The field work would include securing contracts and the planning and supervision of all construction work. The work pertaining to the first division is of a most important character and wise management and sound business in this department are in a large measure responsible for a company's success. On account of the brevity of this paper no further space will be devoted to this department. Consideration will be given to the management of the field work—that part of the work which is of more particular interest to engineers.

The generally recognized principles of good management are four in number and may be briefly stated as follows:

1. The equal division of responsibility between the management and the workmen.
2. The development of a science for each element of the work.
3. The selection, training, teaching and developing of the workmen.
4. The co-operation of the management with the workmen.

Briefly stated these rules may be applied as follows:

Usually the field work would be under the direct control of the general manager. A primary requisite to success is the ability to get contracts that will prove to be desirable work. It is difficult to make a poor job pay even under the best system of management although an intelligent contractor will sometimes take one in order to keep his organization intact.

Second to securing desirable work would be the formation of the organization by means of which the construction work can be done. The building up of the field organization would be part of the duties of the general manager and its personnel is important. It is necessary to carry a permanent force that can be depended upon from year to year, this part of the organization comprising engineers, general superintendents, superintendents, foremen and skilled mechanics. The size of the permanent force would vary depending upon the amount of work undertaken. In a progressive company the permanent force keeps growing proportionately to the increase in business.

The general manager should personally or through his immediate assistants, engineers or general superintendents, keep in close touch with each contract under construction. When a contract was secured, the machinery and tools necessary to do the work would be shipped to the job. Careful planning will save money that would otherwise have to be spent for new plant, as it frequently happens that some special machine can be worked to advantage on several jobs in the same season. The purchase of all material and supplies of any large amount would be done by those in charge of the office work, subject to the direction of those in charge of the field work. A superintendent, together with foremen and skilled mechanics, would be selected to do the work, and the approximate number of laborers necessary to start work would be determined upon. Questions arising relative to the interpretation of specifications, disputes with the party for whom the work is being done, estimating the amounts of work accomplished and the general planning of all the work would be attended to by either the general manager or his immediate assistants.

The foregoing shows to some extent the duties and responsibilities that would be assumed by the management. The superintendent who is assigned to carry out the plans on a contract would be selected on account of his fitness to do that particular job. Every man has his limitations and it is the knowledge of these limitations that enables a successful manager to place a man where he will make good rather than to place him where he will be a failure. Besides being a man of energy and resource, a superintendent should be a man of good character. A contractor's reputation rests to a considerable extent in the hands of a superintendent and a reputable contractor values in no small degree his reputation for doing honest and thorough work. The superintendent would be responsible for carrying out the work pursuant to the plans laid down by his superiors. Delayed shipments, break downs, weather conditions, change of plans and labor troubles all combine to interfere with plans made in advance and the superintendent would often have to use his judgment in dealing with such occurences until he could get in touch with those in charge of the field work. The cooperation of the superintendents, the foremen and skilled mechanics should always be sought in improvising methods to do the work in the most efficacious and economical manner.

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*Instructor in Highway Engineering, Columbia University; Engineer, Lane Construction Corporation.

The superintendent and his formen should use considerable care in selecting laborers to perform different parts of the work and have considerable patience in training them to do it. An efficient gang can be developed only by a continual process of weeding out the poor laborers and the proper selection and training of those remaining. Fortunately many laborers consider highway construction as a sort of trade and they follow the same line of work year after year. If treated right they will seek employment with the same company each season so there is generally a nucleus of experienced laborers available.

A good superintendent should always be cognizant of the cost of the work of each of his gangs and know whether the cost is out of proportion to the work that they are accomplishing. The gangs are never so large but that frequent inspection during the day and some mental calculation serves to show how work is progressing. Frequent visits by those in charge of field work would prevent slight errors on the part of the superintendent from becoming serious. Some companies require the superintendent to send to the office each night a daily report card showing the daily costs of doing the work. The writer believes that with a good class of superintendents who have the benefit of frequent conferences with those in charge of the field work the daily report card system is not worth the trouble. The superintendent should in any case divide the work of the day under several classified heads which would be determined upon by those in charge. If a report of these classified costs for each day were sent into the office only weekly or even semi-monthly, it would prove to be efficient.

The fourth rule, that embodying the co-operation of the management and the workman, is particularly important to all highway contractors' organizations. Construction work of this kind lasts only two-thirds of a year, yet it is remarkable how a reputable contractor will maintain his permanent organization from year to year even though his men are beyond his control for four months. The management must make the men feel that good and faithful work is appreciated and be quick to show it. Even the common laborer should not be forgotten. Although a bonus or other system of increased wages is rarely used by a highway contractor in dealing with his common laborers, the latter should be shown that those who excel gain the reward. Their efforts may be stimulated by seeing the cases of others of their class who are receiving increased pay or have been promoted to the position of foreman.

In concluding the writer believes that the basic ideas contained in the principles of good management previously mentioned in this paper, are fully appreciated and are put into practice by the intelligent and successful contractors.

In deciding to build the immense new dry dock, which forms part of Boston's port development, of reinforced concrete with wearing surfaces, or altars, of granite, photographs of reinforced concrete beams formed one of the determining features. These photographs showed that with proper mixing and treatment the combined chemical and frost action of sea water could be neutralized even when the material was subjected to alternate immersion under water and exposure to the air.

The Neglect of Brick Pavements

FROM recent inspection of a considerable mileage of brick-paved roads and streets, it appears to us, says The Engineering News editorially, that a very considerable percentage of the brick pavements recently laid are suffering deterioration because they apparently have had nothing at all expended on them for maintenance. On many miles of brick-paved roadways in Cuyahoga County, Ohio, which have been laid within a comparatively short time, and are good examples of first-class construction, the only defect noticeable is longitudinal cracks, extending usually along or near the centre of the roadway. So long as these cracks remain merely open cracks, they do no injury to the road and apparently nobody pays any attention to them.

What happens, in no very long time, however, is that the calks of horseshoes and steel tires gradually chip away the sides of the crack, and what has been a crack becomes a groove. As soon as the groove becomes wide enough for a steel tire or a horseshoe calk to drop into it, the destructive effect is rapidly accelerated. One sees not a few places on these brick roads where depressions half an inch or more in depth, and six inches to a foot in width, have been hollowed out along the line of what were originally mere cracks in the pavement.

This is, in fact, exactly what would naturally be expected to happen, and what is bound to happen so long as the fallacy obtains that a brick pavement once well laid needs no repairs whatever. It is entirely true, we believe, that such a pavement needs a comparatively small amount expended on it to keep it in good repair, provided it has been originally constructed in a first-class manner; but that small amount it must have, even though it be as little as $50 per mile per year, or damage will be done compared with which the cost of repair would be a mere trifle.

It would be an exceedingly easy matter when these longitudinal cracks form in a brick pavement, to fill them flush with the surface, either with a cement grout of the consistency of cream, or with a mixture of tar and sand in the same way that cracks in concrete roads are mended. From the practical point of view, the tar and sand is probably the best possible material to use. About the only objection that we know of is that it is more or less unsightly and brings the defect to notice just as it does when the same method of repair is applied to a concrete pavement. If cracks in concrete pavements could be filled with cement grout, so that the cracks would not be noticeable, instead of filling them with tar, which advertises the crack to everybody who passes over the road, the reputation of the concrete road would probably be a good deal higher, even, than it is.

Controller Hebert, of Montreal, estimates that the city has lost no less than "millions of dollars" on sewer contracts during the last quarter of a century. An investigation now in progress which has shown bad leakages is regarded by the Controller as "a drop in the bucket." It is stated that but for the expense and labor involved the Controllers would undertake an investigation of sewer contracts back to 1890.

Don Section, Bloor Street Viaduct, Toronto

THE illustration reproduced herewith is the approved design prepared by the Commissioner of Works, for the Don section of the Bloor street viaduct, Toronto. The length of the viaduct, out to out of the approaches, will be approximately 1,600 feet and the width about 86 feet. Down the centre of the upper deck there will be two electric railway tracks laid in ballast. Provision is also made for two 20-ft. roadways separated from the car tracks, and two sidewalks. The lower deck will be constructed to carry two lines of electric railway for radial traffic, freight or passenger. The viaduct will consist of five main spans, the greatest being 281 ft. 6 in., centre to centre of pins. The height of the roadway above the Don Valley at the deepest point is 125 ft. Approximately 5,500 tons of steel will be utilized in the construction of the viaduct, for which tenders will be called almost immediately.

Road Designing*

By Robert A. Meeker.

THE first point to be considered in designing a road is its width. It may be generally stated as axiomatic that the width of roads should be in multiples of eight, this being the width that should be allowed for each vehicle using the road. A road 8 ft. wide might more properly be termed a lane leading to one building or a small group.

The next in importance should be 16 ft. in width, in order that two vehicles might have sufficient width in which to pass.

The third width, or 24 ft., would permit of two vehicles passing while the third was standing along the side of the road—or two loads of hay or other bulky material to pass.

The fourth width, or 32 ft., permits two vehicles to stand along the sides and leaves sufficient space for two other vehicles, moving in opposite directions, to pass each other in safety. These widths refer to the traveled carriageway alone, no allowance whatever being made for the accommodation of pedestrians, nor for any drainage structures.

In order to obtain a roadway of sufficient width to accommodate travel passing in both directions, 24 ft. may well be taken as the minimum allowable, and if there is the prospect of an increase of traffic in the near future, a proper addition to the width of the surface, necessary for the accommodation of the traffic, should be provided for in the original design. It is almost impossible to properly grade and drain a road of less than 24 ft., and the wider the roadway the more easily it is drained, and also maintained, due to the fact that the surface is more freely exposed to the drying action of the wind and sun, thereby preventing the formation of mud and ruts.

The second problem is that of the location of the line. On a new road this is determined by certain well-defined principles. First, the beginning and ending points should be connected by the most direct line; second, the grades should be kept as low as possible; third, for economy's sake, the line should be so located as to reduce the amount of grading to the minimum, likewise the number and size of the bridges.

The factors governing the departure from a straight line are many. In crossing a ridge we seek the lowest point in the summit, in order to avoid expensive cutting or the alternative of steep grades; in following a valley we keep well up on the hillside, to avoid bridging ravines and small water courses; if we encounter a swamp or pond we can frequently, by swinging the line, save the expense of a heavy fill; a stream may be avoided by diverting the line, thus saving the cost of bridges.

On an old road another set of problems has to be solved; these are chiefly those of expediency. Though a straight line between the termini may not only be

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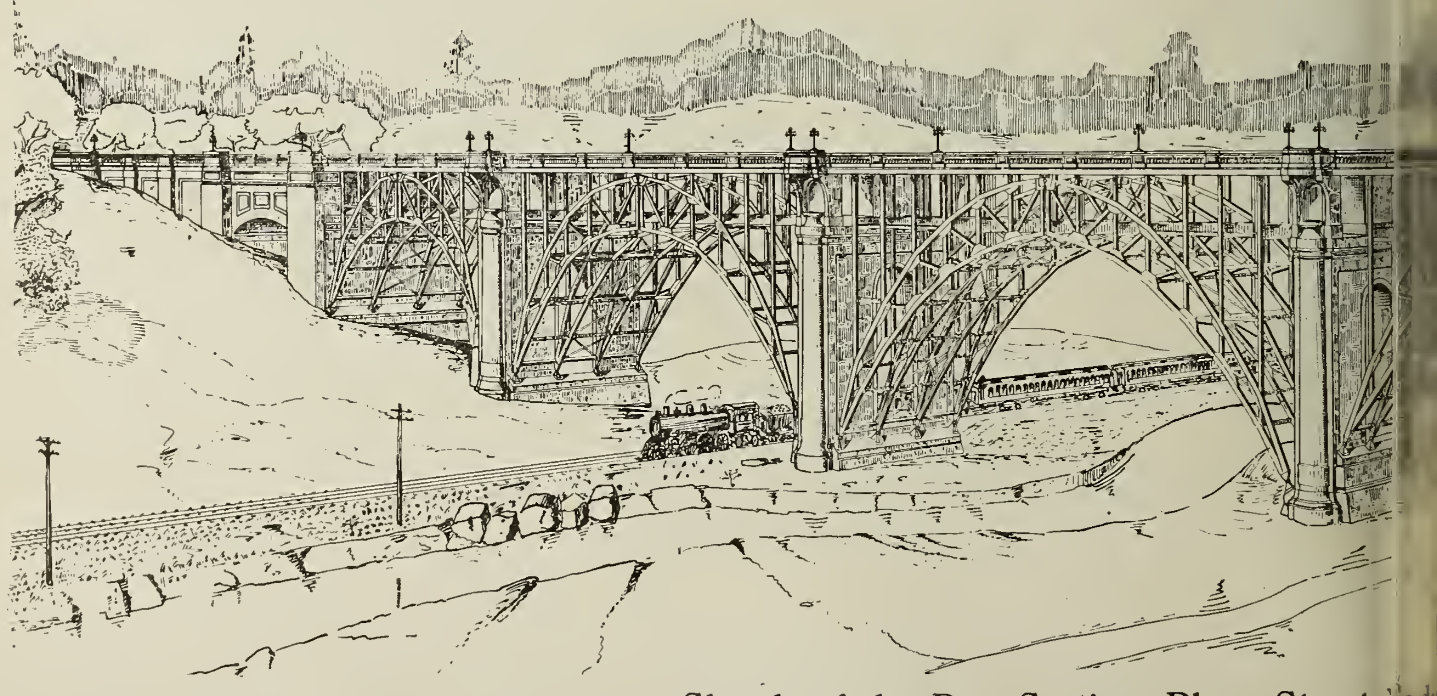
*Paper presented at the First Canadian and International Good Roads Congress at Montreal.



Sketch of the Don Section, Bloor Street

the best but also the cheapest, the claims of intermediate communities may be so strong that the line must be diverted from its best course to satisfy the wants of the communities to be served. But through it all, in spite of all of these warring factors, the engineer must never lose sight of the srtaight level line between two points as his ideal. By keeping this constantly before his mind's eye the results that may be achieved will often surprise even the author.

Grade

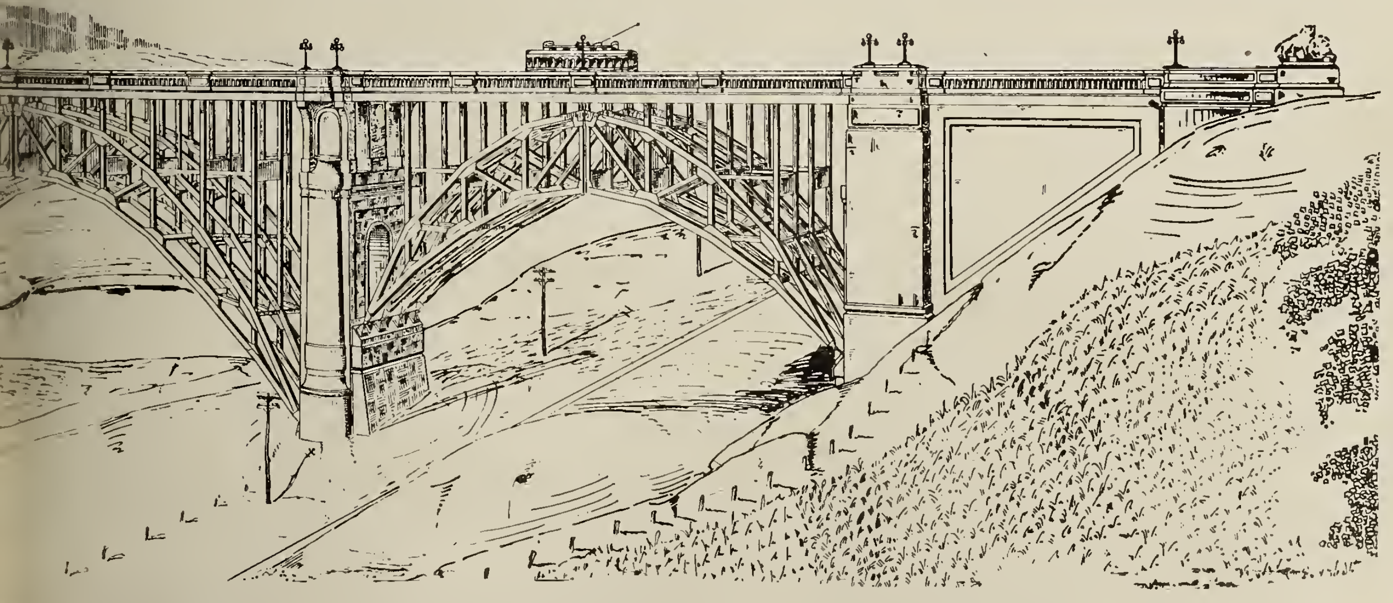
The grade, or the angle which the axis of the road makes with a horizontal line, is the most important economic feature in road design, for upon it depends the amount of material a horse can draw over the road. The results of experiments made both in England and France prove that a horse can haul twice as heavy a load up a 2 per cent. grade as he can up a 6 per cent. grade. That being so, the value of a road for heavy traffic, having a maximum grade of 6 per cent., is only one-half of that having a maximum of 2 per cent. This fact is often lost sight of in designing new grades, the object of many road officials being to build as many miles of road as possible for a given amount of money, the first cost, and not the ultimate value of the road to the community, being the basis upon which the improvement is made. This cutting down of hills and the filling of valleys or reduction of gradients is no new idea, for Isaiah wrote, over 2,000 years ago, his idea of a perfect highway as follows: "Every valley shall be exalted and every mountain and hill shall be made low; and the crooked shall be made straight, and the rough places plain."

Drainage

Having laid out your road as straight as possible, and having reduced your grades as much as your funds will permit, the next important problem is that of drainage. This is of two kinds—surface and subsurface. Surface drainage is both transverse and longitudinal. Every road must be so planned that the water which falls upon its surface will not remain upon or along it. The first object is attained by giving the road a proper crown or cross section, so that the water may be conveyed quickly to the gutters on the sides. This crown should have the form of the arc of a circle, drawn through three points—the center of the road and the gutter on either side. The elevation of these points should be in the following ratio: For earth roads a fall of 1 in. per foot from the center to the gutters; for water bound macadam, ¾ in. per foot, and for bituminous concrete ½ in. per foot. This form of cross section permits of the fullest use of the road, and at the same time conveys the water to the gutters without washing the sides or shoulders of the road. The longitudinal surface drainage is taken care of by the gutters, which must be carefully trimmed to conform to the grade of road, all holes being carefully filled and all humps cut off. In fact, the gutters must be as carefully graded as the center of the road. Proper inlets to bridges crossing the road should always be constructed if the bridge is as wide as the carriageway. In some soils these precautions are not sufficient, and we are then compelled to lay underdrains. These should be placed about 3 ft. inside of the gutter line, for two reasons: First, to intercept the subsurface water before it reaches the middle of the road, and second, to prevent erosion in case the gutters are gullied. The object of underdrains is to cut off the sub-surface water before it can get beneath the traveled road; therefore their place is on one or both sides of the paved way.

The Pavement

The last thing to be considered in the designing of a road is the pavement. This will depend upon the kind and amount of traffic. For country roads gravel or plain macadam is sufficient. For suburban and small town roads a surface treatment, either with bituminous or lignin binders, will suffice; if the traffic is great, bituminous concrete or brick, and in and near large cities, where the traffic is very heavy, stone blocks.



pon which tenders are about to be called.

Analysis of Worn-Out and Ravelled Macadam Surfaces, with Suggestions as to Treatment

THE word ravelling is used rather loosely. I shall consider it as the loosening of the bond of a road surface until the macadam stone lies loose and free on the road. By macadam stone, is meant, not the small stone used to fill voids and give a smooth finish to the surface, but the stone that constitutes the body of the road's surface. In macadam work this stone when compressed to its final form occupies about 60 per cent of the volume of the road surface. The 40 per cent of voids is filled in varying proportion with surface stone, screenings, stone dust, sand, earthy materials and any chemical binder used to "hold the road." The mixture of fine stone, sand and earth filling the voids has no appreciable tensile strength. Its duty is to wedge the macadam stone in place and prevent internal movement. Such a structure is called on to carry loads, to receive and absorb propelling thrusts. The road should be of sufficient depth to transfer the stresses thus imposed to the sub-base without serious internal movement and at unit pressure less than the resisting power of the soil. It is thus subjected to vertical and horizontal forces that contribute largely to ravelling. Let us briefly consider these.

A draft horse weighing 1,200 lbs. will have all his weight at one time on two feet. He will exert say 1 h.p. at a speed of 4 miles. The vertical forces at the foot is 600 lbs., the horizontal $\dfrac{23{,}000}{2 \times 4 \times 88} = 47$ lbs. These forces are or may well be concentrated on a toe calk 2 ins. in width; the resultant force slightly exceeding 300 lbs. per linear inch.

A motor truck weighing, loaded, 16,000 lbs. and exerting at the wheel rims say 30 h.p. at 10 miles an hour, will with 60 per cent of load on rear axle, exert a vertical force of 4,800 pounds and a horizontal of 562.5 lbs. at each rear rim, the resultant being about 800 lbs. per lineal inch for 6-in. tire.

For a pleasure car weighing 4,000 lbs. with 60 per cent of weight on rear axle and exerting 40 h.p. at the wheel rims with a speed of 35 miles, the vertical force at each wheel is 1,200 and the horizontal 214. The resultant is about 400 per linear inch for a bearing width of 3 ins.

At curves with high speed cars, the horizontal force is considerably increased, for it is impossible to so "bank" a curve as to suit the speed of all classes of traffic. In the case of wheels transmitting vertical loads only, observation indicates but little dust raising from a road not overlaid with loose dust. Such a wheel will at the point of mathematical tangency have no velocity relative to the road; a vertical velocity is imparted to it and as any section leaves the surface it will raise with it any of the lighter particles that are loose and may come into contact with it. At the driving wheel there is a slight slip which in addition to lifting will throw particles backwards.

These are the forces tearing at the road surface. In some cases they are more than the road can stand. The horse's calk acts somewhat like a chisel. It will pry out the binding material between the stones as well as the latter themselves when the bond is weakened. The driving wheels of motor vehicles push or suck any material thus loosened out of place. The binder loses weight as it parts with moisture; besides this, without moisture it also loses, not only its property of recementing itself under pressure but to a great extent, its binding power as well. The real work of transmitting the stresses due to traffic must be borne by the stone. These are merely held in place by the binder. The latter is gouged out by the horse, drawn or pushed out by the automobile tire, blown away by the wind, or washed off by the rain and a loosening of the upper stone results.

Even on a well consolidated road climate stresses impose a heavy duty. If, however, there be voids the risk of failure increases. Voids may be due to deficient rolling or to the rise of too much clay in the earthy binder. Lumps of this material will bridge the spaces between stones even under hard rolling The bridge will break down eventually either from pressure or moisture or a combination of them. A void forms where the bridge was and continues rising until near the surface when ravelling results. The same may be true in the cases of too light rolling.

In considering the effect of overloading and neglect it must be borne in mind that any given type of construction may be so maintained as to vastly increase its carrying capacity. The problem is largely one of economics and administration. As an illustration, assume in two cases the same foundation—let one road have a water bound macadam surface dressed with a heavy bitumen forming a sheet about ½-in. in thickness and the other a bituminous concrete (mixed method) surface of say 2 ins. The former will cost about $0.40 for stone and $0.15 for dressing, or $0.55 per square yard, and the latter about $1 (both exclusive of the foundations). With proper care the higher surface will last about three years under fairly heavy traffic, the heavier one an unknown period, but let us assume twelve years. The total yearly charges against the two may then be stated about as follows:

Dressed Macadam—	Cts.
Interest on cost, 55 cts. at 4 per cent	2.2
Depreciation, one-third of 15 cts	5.0
Labor (patrol system)	1.9
Materials:	
Stone ⅜ cu. ft. at 9 cts	3.4
Bitumen, ⅛ gal. at 12 cts	1.5
Total	14.0

Bituminous Concrete—	
Interest on cost, $1 at 4 per cent	4.0
Depreciation, 1/12	8.3
Labor	0.9
Material	0.8
Total	14.0

The fixed charges are 6.2 cts. against 12.3 cts.

The operating charges 6.8 cts. against 1.7 cts.

I do not claim that these figures are more than illustrations of the principle involved. They show a great saving in operating charges, those that show up in the yearly tax bill. The fixed charges, however, are just as real and must be met at some date.

For a road with 9,500 sq. yds. per mile the costs as shown in yearly tax charges, where depreciation and interest are not visible, would in this case be,

For the dressed macadam, per mile	$636.50
For the bituminous concrete	161.50

yet as shown above the real cost of the two roads is the same. This case affects our subject because the treatment of a ravelled road surface must depend on the system of maintenance.

In most communities the great consideration is the next yearly tax bill. If that can be kept down for a period the ultimate economy of such a policy receives but slight attention. It is generally easier to get money for a new road than for repairs. A road requiring a large yearly repair charge is condemned without a hearing. The road calling for heavy interest and depreciation charges may be an equally or even more expensive solution; but the interest charge is not so apparent and the depreciation charge is not made. This is simply putting off the day of reckoning which is sure to come. However, the troubles of those in charge ten years hence are usually lightly borne by the officials of to-day.

If we consider the structure of the road surface we can easily see that the 40 per cent of voids in the macadam stone will be filled somewhat as follows:

	Per cent
Surface stone pasing 1-in. ring and caught on ½-in. ring	15 to 20
Screenings, passing ½-in. ring	15 to 10

When dry the clay is driven off to a greater or less extent as dust washed away or splashed off as mud. Its place is supplied to some extent by detritus, the result of the wear of the larger and heavier materials. These also blow or wash away and the road loses its bond. If our road is not overloaded we can retain its usefulness by making good its losses, with proper materials in their needed proportion. It is here that the trained road man is most needed. Nothing can replace his experienced judgment.

In the case of a ravelled road having first determined that the road was well built we must decide whether the traffic is too great for the type of surface, or whether the failure was due to neglect. If the former we must resurface with some better type. If the latter we can repair the old surface.

Resurfacing should always be preceded by scarifying and by bringing the road up to the necessary depth of stone. For water bound macadam needing greater surface strength several classes of chemical binder may be used of which I shall discuss two—bitumen and lignin.

The bitumen may be applied either by penetration or mixing methods. The former is the cheaper, the latter the more trustworthy. Which method is to be used will, after consideration of the care the road will receive, depend on the estimate of the overload, as will also the depth of the bituminous sheet. My own observation leads me to question the wisdom of attempting to get any thickness exceeding one-half inch by penetration methods. It also leads me for this class of work to prefer tar to asphalt. The former material appears less sensitive to injury by dirt and to yield better results in repair work.

The lignin binders are derived from the waste products of wood pulp or tannin manufacture. They are cements being also used to bind core sand in foundry work and impart a tensile strength to the binding materials. They will not act on materials soaked in the so-called road oils. The action of some of these materials on slag and red shale is quite remarkable. They are slightly soluble in water and will therefore need renewal. Their application, however, is easy and inexpensive and the effect of successive applications seems cumulative, increasing not only the depth of penetration but the strength of the bond. The waterproofing of lignin bound roads with bituminous tops has been carried out in Connecticut but I am unable to give any facts as to the results.

For water bound macadam roads that have failed through neglect a thin coat of gravel carrying some earthy matter or of screenings or coarse sand mixed with earth will usually cure cases that have not gone too far. In some of the counties of New Jersey it is usual to fill all ruts, etc., with fine stone and to give the middle of the road a coat of the same mixed with a little clay. Much of this material is wasted by being thrown off the road by the traffic, and old ruts almost invariably reappear. This method, however, is very successful in preventing ravelling. It seems a false economy to omit rolling and wet rolling, at that. The same is true of patching holes with anything but macadam size stone. The roads treated with small stone are yearly losing depth. The moisture for wet rolling is usually bountifully supplied by nature in the early spring. It can also be had by the use of hygroscopic salts where water is hard to get. Traffic will usually throw off from the road surface enough stone to pay for rolling.

A treatment of clay, without rolling, will often give astonishing results. Such treatment, however, seems only a palliative not a cure. Roads thus treated become dusty or muddy according to the weather, show a tendency to ravel again and are hard to properly treat with bitumens. They will, however, take the lignin binders with good results, if the dose of clay has not been excessive, or if the excess is swept off before treatment.

Brick roads in Cuyahoga County, Ohio, will be increased 60 miles in length during the present season, according to the plans recently announced by the County Engineer. There are already about 400 miles of brick pavement in the county. A minimum width of 16 ft. has been adopted for the new roads. The present season's work will amount to about $900,000.

Gas in a deep cesspool in East St. Louis caused the death of the contractor who had built the cesspool, and of two other men. The contractor, discovering that a tool has been left at the bottom of the pit just completed in the rear of a grocery store, started down a ladder to recover it and was overcome by gases and fell into about 6 ft. of water. One after the other, two assistants who attempted to rescue him were overcome and fell. A fourth man was pulled back unconscious, before falling. The pit was 22 ft. deep by 18 ft. in circumference and connected to an old cesspool. It is supposed that the fumes came through the connecting pipe after the water in the old pit had run into the new. A lighted lantern is said to have been extinguished by the fumes.

Suit is being brought against the city of Chatham, Ont., to prevent the corporation from emptying sewage into the River Thames. The Provincial Officer of Health states that it is illegal for the city to pour sewage into the river, but in view of the fact that it cannot call a halt to the practice without creating a greater nuisance, he is of the opinion that reasonable time should be allowed to provide for suitable means of disposal. The action is a timely one, and we trust that the example will not be lost upon many other municipalities throughout the province.

Grades and Leakage in Intercepting Sewers

By J. N. Ambler, Winston-Salem, N.C.

IN spite of the view of many authorities that extremely flat grades are practicable, in sewers of this kind, because of the greater flow, and the fact that the sewage has become thoroughly macerated by the time it reaches the interceptor, the writer is thoroughly imbued with the belief that all the fall available should be obtained. This belief rests on his experience in cleaning out intercepting sewers after having been in use, and, of course, neglected, for many years.

All the sand, mud and illegitimate matter of all kinds which gets into the various closets, or through the manholes in the streets, is pushed down the sewers of sharper grade, and finds a resting place in the interceptor.

The writer once removed some twelve of fifteen hundred bushels of such substances from about half a mile of old interceptor. Most of this was sand, but bottles, rags, straw hats, overalls, stones, wooden articles, etc., were also present, and the capacity of the sewer was greatly reduced.

Of course, hard and fast rules cannot be laid down, but the writer does not feel good in laying a grade as flat as 1 foot per 1,000. It is his endeavor, in the light of experience with cleaning, to get all fall possible.

From the very nature of the low, level intercepter, it is usually located where the ground is alluvial, and with the ground water level near the surface.

In many cases the ground to be traversed is marshy, and in nearly every instance the sewer is laid below ground water level.

These conditions are distinctive for the style of work and require special methods of treatment.

Unless the joints are laid very perfect, and so maintained at the flat grade as to utilize all the fall, without pockets, the infiltration of ground water will be so great as to greatly reduce the carrying capacity of the sewer, or even, in the case of a long line, to completely destroy its usefulness.

Settling of the joints will, of course, render the conditions worse, and may result in the inflow of quicksand until the sewer is put out of commission, as in a case which once came under the writer's charge for correction.

It is, therefore, of the utmost importance, not only to have perfect joints, reducing the inflow of the ground water to a minimum, but also to provide means to maintain the grade as a perfectly straight and rigid barrel, free from settlement.

The difficulties of meeting this last requirement are often very great, as usually the bottom of the trench is a water-soaked quagmire and frequently quicksand.

Considering, first, the question of perfection in the joints, the writer has specified a mortar of neat Portland cement, on account of its density and imperviousness.

The shrinkage of neat cement mortar being considerable after the mortar is set, a wash of thick grout is used to fill the cracks.

The entire circumference of each joint is rigidly inspected by hand, and no imperfect joint is left on the work.

Special compounds, as melted sulphur, and the various elastic compounds from which it is claimed that perfect joints may be made, even in water, were not tried, either on account of the expense, or because there was doubt felt as to the durability of such substances.

Feeling the necessity of having some criterion upon which to base the engineer's acceptance of the work, so far as ground water is concerned, the writer read up all available data on ground water flows, and came to the conclusion that it is a subject about which too little is known, and what is known is conflicting.

There should, however, be some criterion to apply to work done by contract, and it seemed that nothing better could be done than to determine how much water the sewer might be allowed to carry without materially injuring its usefulness. The criterion should not be so severe as to greatly affect contractor's bids.

Such a criterion, it would seem, should be based upon the number and circumference of the joints.

The following clause appears in one of the writer's specifications, and is offered for what it is worth, until something better can be substituted. It, at least, has had the effect of securing some very careful work, and contractors were not disposed to regard it as severe when thoroughly explained to them.

The clause is as follows:

"It is the intent of these specifications that no more leakage of ground water into the sewer be allowed than is admissible with a first-class piece of work, in which care has been exercised to get as near as possible to a water-tight result.

"To determine the admissible amount of leakage, the length of a joint will be considered as the outside circumference of the spigot end of a pipe.

"Leakage not in excess of two gallons per day of 24 hours for each foot of circumference of every joint will be considered admissible, the amount of flow to be determined by the engineer's gaging in each section, by means of a notch board.

"The contractor agrees that for each 10,000 gallons per day of 24 hours by which the total flow of the sewer exceeds what the total flow should be, when figured on the basis already given, a deduction of $100 from the contract price will be made.

"This will not apply further than to a total flow resulting from three gallons per day of 24 hours, from each foot of joint length, beyond which figure the sewer will be regarded as not in compliance with this contract."

The writer's opinion is that the above requirement is a very mild one, as he once laid a mile of large sewer through exceedingly swampy land, passing under several streams, etc., with a result that not more than a stream one-fourth inch deep was flowing in the bottom of the pipe at the lower end on completion.

However mild the criterion may be, it has had a powerful deterrent effect against bad work.

It is extremely important that the manholes should not leak. To prevent this, the best hard bricks are used, each being dipped in a pail of water, as handed to the mason.

The brick work rests on a cement bottom 12 inches thick, with a solid cement invert and the contact of the pipe with the masonry is an object of especial care.

Manholes are built up sufficiently high above the meadow to prevent being stopped by floods.

The caps are secured to the covers by two set screws to prevent malicious persons from placing foreign substances in the sewer.

The handling of water in the trench during construction is usually less serious than the inexperienced are apt to imagine. A diaphragm pump connected to a small gasoline engine is the cheapest and best way known to the writer for removing the water. A small trench is excavated along the side wall of the main trench which conducts all accumulated water to a pump, where it is promptly removed by pumps, without being allowed to rise on the freshly constructed sewer line.

The writer has used the pile and platform method of founding, and finds it of very general application, of moderate cost to handle, and very satisfactory in result.

Softening Water Supplies*

Action of Permutite and Allagite in Removing Hardness

THE hardness of water, as is well known, is in proportion to the lime salts and magnesia salts dissolved therein. We distinguish between temporary and permanent hardness. Temporary hardness is due to the presence of dissolved bicarbonates of lime and magnesia which, when the water is boiled, are changed to insoluble carbonates, which then are precipitated. Any remaining hardness is the result of dissolved sulphates of lime and magnesia, which, when the water is boiled, still remain in solution therein.

Recently two new processes of water purification, which are essentially different from those hitherto known, have been devised. They are known as the "Permutite" and the "Allagite" processes. Both are based on the properties of certain substances to absorb the hardening elements (lime and magnesia) in the water and to give up to the water a harmless substance, soda.

In testing several natural zeolites Dr. Gans discovered that, as regards their ability of taking up bases from aqueous solutions, they had very different properties. Based on these discoveries Dr. Gans classified the zeolites into aluminous silicate and double silicate of alumina. In the first class he placed such zeolites as hold their exchangeable bases combined with silicic acid.

He endeavored, then, to produce on artificial product which should be practically available, by making artificial chabasite, which in nature belong to the group of alumina silicates.

On a commercial scale this product can be made by melting together three parts of kaolin, six of quartz and twelve of sodium carbonate. The resulting melted mass is made into a lye with hot water, for the purpose of hydrating it and removing any soluble silicates. By washing and handling in a centrifugal, the remaining granular material is freed as far as possible from the final alkaline lye, then stored in a moist condition. In this manner there is formed an artificial aluminum silicate, which is put on the market under the name of "permutite," in the form of white, sometimes granular, sometimes lamellar crystals. This artificial product possesses in a high degree the property of taking up lime and magnesia from aqueous solutions, and replacing them with a corresponding equivalent of sodium in solution.

Softening the water by the aid of permutite is effected by passing it slowly through filter beds of the permutite. In its passage through the permutite the water gives up to the latter its entire contents of dissolved lime and magnesia, in exchange for which the permutite yields up to the water the correct chemical equivalents of soda. Chemically speaking, the sodium atoms combined with the alumina of the permutite are replaced by lime and magnesia atoms.

The permutite is thus gradually changed from a pure sodium zeolite to more of a calcium-magnesium zeolite. When all the replaceable sodium atoms are supplanted by calcium and magnesium atoms, the peculiar property of the permutite is at an end.

In the practical use of this material, the softening process is naturally not carried so far as thorough exhaustion of the material. On the contrary, as soon as the water shows any traces of hardness (which may be detected by the use of ammonium oxalate or by a soap solution) steps are taken to regenerate the permutite. This regeneration is effected by first freeing the filter from dirt, dust and the like, and loosening its texture by treatment with water, and then passing through it a comparatively concentrated solution of a sodium salt—preferably a solution of common kitchen salt (sodium chloride). There then results the converse reaction to the softening process above described. In the regeneration process the sodium atoms of the saline solution drive out from the permutite the previously taken up lime and magnesia atoms, and take their place. Thus, in the regeneration, the calcium or magnesium zeolite is again transformed into a sodium zeolite, that can be used again for water softening as at first described. While Dr. Gans manufactures artificial zeolite as a crystalline-lamellar substance and makes its property of exchanging atoms of practical use in purifying water, Kobelt, the inventor of the "allagite" process, takes another route. He made experiments as to whether besides the long known natural zeolite there were not other natural products which have the property of readily exchanging or replacing their bases; and found that the so-called "rock glass" or volcanic glass, also, operated in this manner. This, however, does not exist in already available condition, but must first, by a mechanical process, be purified from its inefficient materials. The material, separated from volcanic rocks by a simple process, is put on the market under the name of "allagite" and consists of a dark brown porous mass with grains about one millimeter in diameter. Chemically it differs from permutite in that, while the latter is a true chemical compound, allagite may be considered as a so-called permanent solution.

The method of using allagite for softening water is the same as that described for permutite. The same is true as regards its regeneration, which is effected by treatment with a 4 to 5 per cent solution of common salt.

But from another point of view the new softening processes are far in advance of the usual lime and soda method. In the textile industries (as silk dyeing), in laundries, etc., these two materials do away with difficulties where other processes do not. Outside of softening the water, they can remove iron and manganese. Most surface water contains iron in the form of dissolved oxide compounds; usually carbonates and sulphates. If the water comes in contact with the air, the dissolved iron precipitates and leaves the originally clear water cloudy and muddy in appearance, and useless for most industrial purposes. Further, the conduits are fouled by the iron precipitates.

Such water has been freed from iron and manganese by aeration by well known processes, but these do not, as a rule, effect perfect deferrization of the water. In particular, water that has in solution iron in combination with organic substances is very difficult to free from that metal. Often the filtration is attended with difficulties. For this reason the permutite manufacturers have put on the market manganese filters which are saturated with higher manganese oxides. By simply passing the water through the permutite filter it is freed from both ,iron and manganese. The manufacturers suggest first adding to the water, very gradually, a very dilute solution of potash permanganate. This facilitates the formation of fine colloid precipitates of manganese hydroxides, which are favorable to the separation of the iron. The small amounts of manganese introduced into the water by the permanganate are absorbed by the permutite. The precipitated iron collects principally in the upper filter layers, from which it is removed from time to time by washing.

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* By Robert Grimshaw in the Municipal Journal.

When the manganese filter is exhausted—which occurs when the oxygen of the higher manganese oxide has been taken up by the iron—the filter is regenerated by treatment with permanganate of potash or of calcium. In this regeneration, the lower manganese compounds in the filter are changed into higher oxygen compounds.

"Oxyd-allagite" contains, also, higher manganese oxides, which, in the same manner as above described for permutites, give up oxygen and change the soluble suboxide iron compounds into soluble oxides and hydroxides, which precipitate.

While the manganese is artificially introduced into the permutite filters, the natural allagite filters already contain manganese; so that allagite is made ready for use as a deferrator and demanganator by simply treating it with permanganates.

If the permutite and allagite processes are compared, it appears that they give equally good results in softening, deferrating and demanganating water. The allagite process has the advantage, when used on carbonated water, that allagite is perfectly resistant to acids, while permutite is attacked by them.

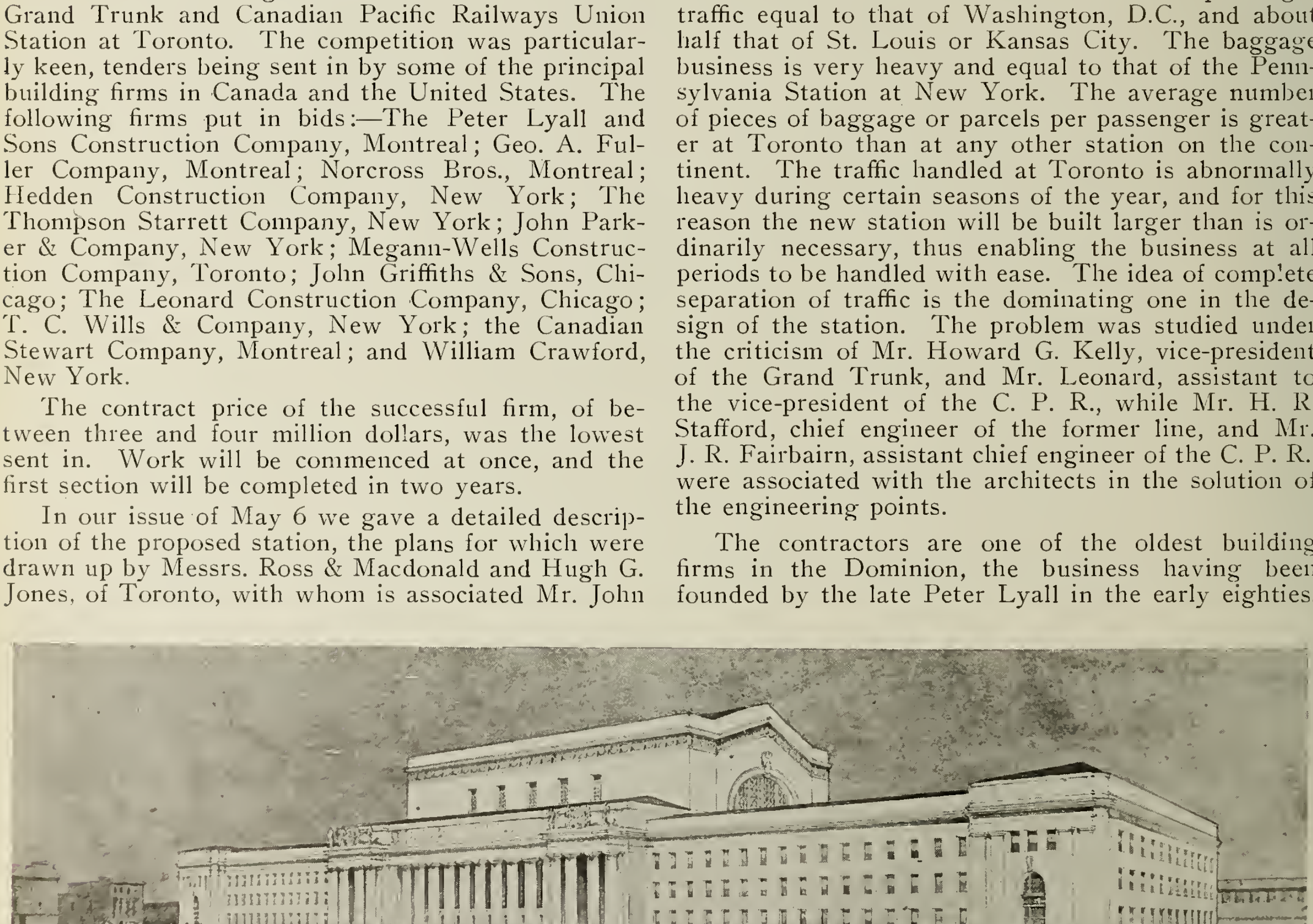
Montreal Firm Secures Canada's Largest Building Contract

TO a Montreal firm, the Peter Lyall and Sons Construction Company, Limited, has fallen the honour of securing the largest building contract ever given out in Canada—that of the Grand Trunk and Canadian Pacific Railways Union Station at Toronto. The competition was particularly keen, tenders being sent in by some of the principal building firms in Canada and the United States. The following firms put in bids:—The Peter Lyall and Sons Construction Company, Montreal; Geo. A. Fuller Company, Montreal; Norcross Bros., Montreal; Hedden Construction Company, New York; The Thompson Starrett Company, New York; John Parker & Company, New York; Megann-Wells Construction Company, Toronto; John Griffiths & Sons, Chicago; The Leonard Construction Company, Chicago; T. C. Wills & Company, New York; the Canadian Stewart Company, Montreal; and William Crawford, New York.

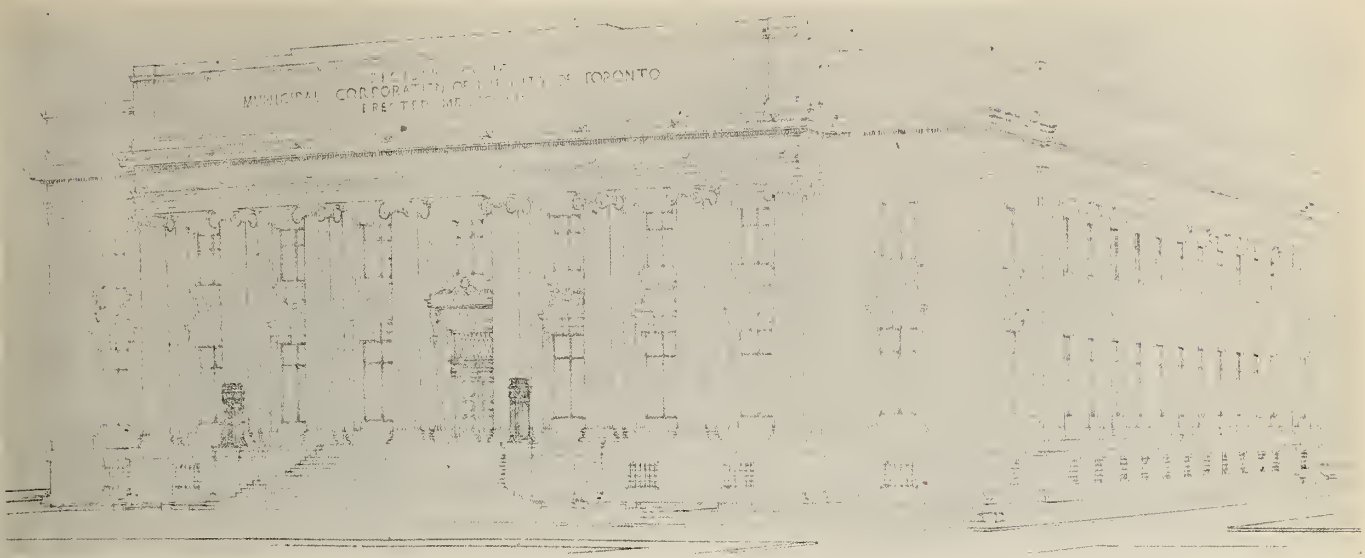
The contract price of the successful firm, of between three and four million dollars, was the lowest sent in. Work will be commenced at once, and the first section will be completed in two years.

In our issue of May 6 we gave a detailed description of the proposed station, the plans for which were drawn up by Messrs. Ross & Macdonald and Hugh G. Jones, of Toronto, with whom is associated Mr. John M. Lyle, of Toronto. The problem was studied for several months and involved visits to some of the principal United States cities, where similar traffic is handled. The architects found the Toronto passenger traffic equal to that of Washington, D.C., and about half that of St. Louis or Kansas City. The baggage business is very heavy and equal to that of the Pennsylvania Station at New York. The average number of pieces of baggage or parcels per passenger is greater at Toronto than at any other station on the continent. The traffic handled at Toronto is abnormally heavy during certain seasons of the year, and for this reason the new station will be built larger than is ordinarily necessary, thus enabling the business at all periods to be handled with ease. The idea of complete separation of traffic is the dominating one in the design of the station. The problem was studied under the criticism of Mr. Howard G. Kelly, vice-president of the Grand Trunk, and Mr. Leonard, assistant to the vice-president of the C. P. R., while Mr. H. R. Stafford, chief engineer of the former line, and Mr. J. R. Fairbairn, assistant chief engineer of the C. P. R., were associated with the architects in the solution of the engineering points.

The contractors are one of the oldest building firms in the Dominion, the business having been founded by the late Peter Lyall in the early eighties.



Architects' perspective of the proposed Union Station, Toronto.


MUNICIPAL CORPORATION OF THE CITY OF TORONTO

The City of Toronto's proposed Registry Office.

They have carried out some of the largest contracts in this country, including the Dominion Express and Transportation Buildings, Montreal; the Central Union Station, Ottawa; the Saskatchewan Parliament Buildings, Regina; the Royal Victoria Hospital, Montreal; the C. P. R. station and offices, Winnipeg; the G. T. R. offices, Montreal; the Technical School, Montreal. At the present time they have in hand the new customs warehouse and the Sun Life Biulding, Montreal, two of the most important structures of this season. They are exceptionally well equipped for undertaking large contracts, having their own carpenter, marble, stone crushing and stone departments. At the beginning of the year, work to the value of $3,300,000 was in hand, and with this new contract the firm will have secured more business than any other Canadian building firm this year. Mr. William Lyall, the President, has been associated with the business all his life and during his father's later years was managing director.

Proposed Registry Office, Toronto

We reproduce herewith the architect's perspective for the new Registry Office, Toronto, tenders for which are now being called and close on the 18th instant.

It will be remembered that the design for this building was selected after a competition in which Charles S. Cobb, of Toronto, obtained the first prize; Messrs. Chapman & McGiffin, of Toronto, the second prize; and Messrs. Symons & Rae, of Toronto, the third prize. The estimated cost of the building is placed at $400,000. The requirements of this building are peculiar in that there is to be housed under one roof duplicate organizations similar in every respect, one for the registry division east of Spadina Avenue, and the other for that west of Sapdina Avenue. As stipulated in the programme, it was thought desirable to face the building toward the south, so that the conditions required a structure symmetrical about a centre axis running north and south, and the accepted design is a direct solution of these requirements of plan. The design, however, has one major feature which peculiarly enough was overlooked by most of the competitors in the competition, and that is a well-marked separate entrance for the clerical staff, which allows them access to the building during hours when it is closed to the public, and thus obviates troublesome interference. The searching office has light and natural ventilation on all three sides.

The elevation on Albert Street is a Roman octostyle portico, while the lateral facades on Elizabeth and Chestnut Streets are treated in a simple way with ten pilasters, embracing with their corner piers the entire length of these elevations.

The population of the United States on July 1, 1914, was 109,021,992, according to estimates made by the Bureau of Census, Washington, D.C.

A cheap concrete warehouse, 1,000 feet long, on the property of the Southern Pacific Terminal Company at Galveston, Tex., divided into four compartments, complies with underwriters' requirements and was built at a cost of slightly less than $1 per square foot. The floating foundations are supported on a sandfill dredged from Galveston Bay.

In the removal by blasting of a reinforced concrete bridge pier 37 ft. long, 30 ft. wide at one end and 17 ft. wide at the other and 16 ft. thick, which had fallen over on its side and was blocking a river channel in Indiana, the dynamite was placed in a rather unusual manner. In half-bushel market baskets mud was laid on the bottom and sides; dynamite was then placed on the bottom mud and covered with more mud. The baskets were then lowered against the concrete pier and the dynamite discharged. This method was successful in pulverizing the concrete so that piles could be driven through it, and new piers constructed on the site of the old ones.

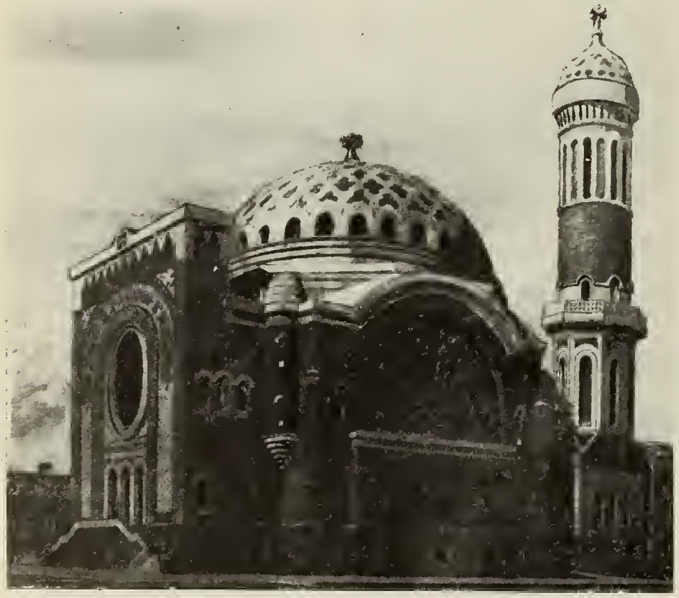
The Pan-American States Association building, which is to be erected in New York, is to be the tallest building in the world, if we disregard the Eiffel Tower, in Paris, which is not really a building at all in the usual sense of the word. The Pan-American building will have fifty-one storeys, two or three of which will be under ground. The height, including the human figure at the top, is 894½ feet. The Eiffel Tower is 984. The Woolworth building, although it claims six more storeys than the Pan-American, is but 750 feet high.

St. Michael's R. C. Church, Montreal

THE accompanying cut of St. Michael's Roman Catholic Church, to be erected at the corner of St. Viateur and St. Urbain Streets, Montreal, from designs by Messrs. Beaugrand-Champagne and Chenevert, Montreal, shows a building in the Byzantine style, which marks a complete departure in ecclesiastical architecture in the city. The church will be entirely of reinforced concrete, which, too, is a departure as regards this class of building. The exterior will be of Greendale Rug brick, with stone trimmings and insert panels, decorative in design, composed of different coloured terra cotta. On the front elevation, on St. Urbain Street, there is to be a wide panel of terra cotta with the inscription "Deo dicta in honorem Sti. Michaelis"—"Dedicated to God in honor of St. Michael."

Two features are the central dome, of concrete waterproofed, 75 ft. in diameter and 104 ft. in height from the floor, and the tower 160 ft. high. A shamrock design will be traced on the dome and the cap on the tower.

The interior walls will be lined with marble, from the floor to the springing of the main arches supporting the dome. The vaulting and spandrils will be of tile specially made for the job. The dome will have a double shell, and the inside one and the cupola over the choir will be decorated with paintings of sacred subjects. Three large stained glass rose windows will give ample lighting to the interior. The vestibule, main and choir floors will be of Flemish tiles, and marble steps will lead from the auditorium to the choir, which will be 53 feet wide and 33 feet deep. The main floor surface is to be 171 ft. 6 in. by 90 ft., and every worshipper will have an unobstructed view of the fine altar.


Proposed St. Michael's R. C. Church, Montreal.

The baptistry will be on the St. Urbain street side of the choir, immediately under the tower, while the sacristy is on the opposite side. The organ tribune is to be placed over the vestibule.

Lighting is to be by electricity, and artistic fixtures will be suspended from the roof. Carrying out the object of making the building fireproof, the doors and window frames will be of bronze. There will be five entrances leading into the main building, three in front and two on the sides.

The ground floor is supported on the basement by reinforced concrete arches of 54 feet span, thus avoiding the use of pillars. The church will have a seating capacity of 1,300 and the basement (which will be 15 feet high) of about 1,100. The basement will be used as a temporary church while the main structure is being erected and afterwards for social church purposes.

What is an Architect?

By Joseph Losekann

TO begin with, an architect is a man, or woman for that matter, who has made a thorough study of all branches of the construction of buildings and has had the practical experience as well. He should have studied architectural design through all its evolutions from long before the Christian era and before Egypt itself, through the different periods to the present day, and should embody in his design of a building that which is essential for its present needs and style, having learned from what has been done in the past and erect a building that should stand as a monument for the future. It should be modern in appearance as well as in material in order to meet the present-day requirements.

An architect must thoroughly understand building construction—a most vital point—as a building poorly put together is little better than no building at all. He should understand the weight and strength of materials, in order to properly apply them and make the building he is constructing a complete whole.

He should understand the planning of a building, which requires thorough training and experience, without which no building can be successful unless its arrangement of plan is simple and economical. The successful plan, therefore, is the one that meets all requirements as to beauty of design and good construction with the least expenditure.

The architect should understand and know of all the different materials that enter into the construction of a building and should specify and see that only the best are put in for the money. He should keep in touch with the newest materials through their many agents and by reading the advertisements, and should always be abreast of the times as to what is the very best and latest on the market.

He should be an impartial superintendent and work for the best interests of the owner, though with proper regard for the contractor as well. It is to the architect that all difficulties that may arise and the proper interpretation of the plans and specifications are left and it is the satisfactory handling of these things that determine the architect's real competency. Judgment should be rendered impartially and a firm stand taken to effect a speedy completion of all matters. The inability to decide quickly and finally on many small things is often the cause of unnecessary delay, and could be avoided by quick action on the part of the superintendent.

Finally, I would ask: Why should you go to an architect to have your plans drawn for a building when there are many contractors, carpenters and others that will make them for you without cost? By way of comparison let me ask, why do some people, when they are sick and in pain, go to a drug store for advice and medicine instead of seeking the professional services of a physician? To save the doctor's fee, of course. The druggist, except in exceptional cases, is not a doctor and does not understand the planning and arrangements of the human body. The

Residence to be erected at Regina for Mr. R. H. Read at a cost of $30,000.

wise person is the one that goes directly to a good physician at the start and pays a reasonable fee for professional advice. The doctor furnishes the prescription as the contractor would construct the building, and the result is, the patient (owner) has a body (building) when properly attended to that is left in the best condition possible for the skill and money expended and in that he more than saves the doctor's (architect's) fee. Everything has been done by the right person in the right way and naturally is bound to bring the right results.

Structural steel frames of very considerable size and complication of design are being used in Europe as hangars for large dirigible balloons. In general, these sheds consist of a series of simple arch frames, similar in design to the usual armory roof in this country but of much lighter material because of the very light roofing. They are usually rectangular in plan, providing room for one airship with exit or entrance at either end, but some of the newer sheds are wide enough for two airships, side by side, and proposals have been made to build them in triangular or in starshape plan, so as to provide entrance in the direction best favored by the prevailing wind. To accomplish this latter end, at least one shed has been built, 443 x 85 feet in plan, mounted on a turntable so that it may be turned to meet any wind condition.

Constructional Progress at Regina

THE substantial character of the development that is going on at the Saskatchewan capital is shown in the illustrations reproduced herewith. The upper view is from a photograph of the architect's perspective of the new $30,000 residence for Mr. R. H. Read, and the lower view is from an elevation drawing of the Saskatchewan Co-Operative Elevator Company's building, which is estimated to cost $75,000. The Read residence is distinctive architecturally, but not from the standpoint of its construction and equipment, for of late years there has been a notable improvement in the character of the better-class dwellings erected at Regina. The Elevator Company's building is being erected by a firm which is in reality a farmer's organization, backed by the Provincial Government. Up to the present time quarters have been occupied in one of the large buildings in Regina, but the staff has increased so rapidly and so many new grain elevators have been erected that it has become imperative to build an up-to-date office building. This is an important step forward in the farmer's co-operative movement in Saskatchewan.

In using coloring matter with mortar or concrete, the color should always be mixed dry with cement, before any sand or water is added.

Saskatchewan Co-Operative Elevator Company's proposed new building at Regina.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

A subway, estimated to cost $190,000, is to be built under the C. P. R. tracks at Park Avenue, Montreal. Tenders will be called shortly.

The Canadian Hart Accumulator Company, Limited, has been incorporated with a capital of $300,000. The head office will be at St. John's, Quebec.

For June the Montreal building permits totalled $2,278,424, a decline of $334,828 as compared with June, 1913, although the permits issued increased 105. During the six months there was a falling off of $1,420,376 in the value of the permits issued.

The town of Alberton, N.B., have just awarded a contract to the Canadian Fairbanks-Morse Company, Limited, St. John, N.B., for a complete electric light outfit, consisting of dynamo, switchboard and the necessary transmission material for their new town lighting system. The dynamo will be driven by water power.

From Quebec comes the report that the improvements to the St. Charles River which are being carried out by Messrs. Quinlan & Robertson are making rapid progress. The work consists of the construction of a large dam and two locks. Two cofferdams have been completed, while the construction of a third is under way.

A stone crusher plant, estimated to cost $100,000, is to be erected at Rigaud, Que., by the Rigaud Granite Company, Montreal. Tenders are about to be invited for cars, electric motors and general machinery, and also for the building. The cost is inclusive of the building and machinery. Messrs. Poullin and Poirier, of New York, are the architects.

Toronto's building permits are making an excellent showing this year. For the six months ending June 30, the total was $13,476,140, as compared with $13,584,725 for the corresponding period last year. Last month's total was roughly three million dollars—a million more than for June, 1913. The number of permits issued this year is greatly in excess of last year.

Construction work has started on the big turning basin in the Fort William harbor, five miles from the mouth of the Kaministiquia River. Two clam-shell dredges are busily engaged in taking out loose earth and in about two weeks the large dipper dredges of the Great Lakes Dredging Company will also be in operation. The making of the turning basin is a hugh undertaking. Over thirty-five acres of solid earth will have to be removed before the basin is finished. It will take some two years to complete the work.

Reclamation work on the site of the new docks at West St. John, N.B., will be rushed rapidly towards completion during the balance of the summer. In order to meet the demand for increased area for tracks and sheds, a third clam digger has been ordered by the contractors and will be in operation within a few days. The new machine is of the latest design and is more powerful and speedier than the two now in use. Announcement is made that tenders have been called for the extension of the Negrotown Breakwater, an action which has been pressed upon the Dominion Government for some time.

It is understood that the Commission which is preparing plans for the city of Ottawa and district is providing that the roads leading into the city shall be 100 feet wide. Richmond Road, for example, which will be the main thoroughfare for all that part of the country into Ottawa, will be made this width. This is considered a wise precaution as the road will have to carry an immense amount of traffic in the future, and it is felt that provision should be made now when the widening of twenty-five feet on each side can be carried out at little expense. Other one-hundred-foot roads will be Pacific Street and the Merivale Road. All other roads of any importance will be made wide now in order to provide for future expansion of the Federal Capital.

Extensive enlargements of the power plants on the St. Mary's River at Sault Ste. Marie will be undertaken as the result of the decision of the International Joint Commission in the case of the Michigan Northern Power Company and the Algoma Steel Company. The former company has been granted a lease by the United States Secretary of War of 25,000 second feet of water, with provisions for additional water during high water periods. The Algoma Steel Company also has been granted additional water rights on the Canadian side of the river. The two companies applied to the International Joint Commission for approval of the plans for compensating works and for permission to construct them and divert the water into their power canals. The compensating works will consist of 16 Stoney sluice gates of about 52 feet span each, 12 of which will be built by the owners of the American company and four by the Canadian interests. In addition a dike will be constructed.

WESTERN CANADA

The erection of a 100-room hotel at Prince Rupert is proposed by Messrs. M. Albert and George A. Sweet.

The Pacific Great Eastern Railway is rushing construction on its line between Vancouver and Fort George, B.C. The Squamish section is 93 per cent. completed, and track has been laid to within 20 miles of the Pacific Coast terminal. Over 5,500 men are now engaged on the construction work.

Messrs. Stevens Brothers are the contractors for the First Presbyterian Church which is to be erected on Quadra Street, Victoria, at a cost of $130,000. The architectural style of the new building will be perpendicular Gothic. The plans were drawn by Mr. J. C. M. Keith. The new building will contain an auditorium with a seating capacity of thirteen hundred.

Tenders are being taken in connection with an important contract at Steveston, B.C., where a jetty, 7,100 feet long, is to be built at a cost of $150,000. The jetty is to be built of tiers of mattresses and rock. The bottom or apron mattress is to be 190 feet wide—95 feet on either side of the entire line of the jetty. The work is a Dominion Government undertaking.

There are between four hundred and five hundred men employed in the construction of the Government Interior Storage Grain Elevators, which are at present being constructed at Moose Jaw at a cost of $1,500,000. The elevators will have an initial capacity of 3,500,000 bushels and they are being constructed so that the capacity can be increased to 20,000,000 bushels, as necessity demands.

The Canadian Pacific Railway have completed their line from Expanse to Assiniboia for a distance of fourteen miles south of Expanse and the Moose Jaw City Council and the Board of Trade have waited on General Superintendent Taylor, of the Canadian Pacific Railway, asking to have the line continued through to Assiniboia at the earliest possible date. Only fourteen miles remain to be completed to make direct railway connection between Moose Jaw and Assiniboia. The towns on the Weyburn-Lethbridge line are also petitioning the company to construct the line at once, in order to give them communication with the main line of the Canadian Pacific Railway.

The Directors of the Burrard Inlet Tunnel & Bridge Company have taken another step forward looking to the award of a contract for the construction of the proposed Second Narrows bridge. Three firms are in the running for the work, and it has now been decided to call in an arbitrator. The tenders under consideration are as follows: Canadian Bridge Company, $1,846,000; Dominion Bridge Company, $1,916,000; C. A. P. Turner, $1,744,831. The Government, which has passed a subsidy of $400,000, has requested that no definite decision be made without first conferring with the authorities. The figure originally submitted by the Canadian Bridge Company was $2,076,218. This bid was modified, following the announcement that the Board would consider revised schemes, to $1,916,000, following by another reduction to $1,846,000. The Dominion Bridge Company quoted $2,287,791, then afterwards reducing its bid to $2,175,000 and $2,075,200, and finally revising the figures to $1,916,000. In the case of the Turner design, the original tender was $1,679,331, but in order to conform with certain technical changes suggested by the company's engineers, the bid was later augmented to $1,744,831.

We have to thank Mr. W. A. Littlejohn, City Clerk of Toronto, for a copy of his Municipal Hand Book, which is brimful of information appertaining to every department of the city's activities. This publication should be especially valuable for reference purposes.

Messrs. Laurie and Lamb, Montreal, have received an order from the Abitibi Pulp and Paper Company for four 500 brake-horse-power Bellis and Morcom engines, to drive their paper machines by rope drive. The Alberta Government have also ordered a 180 brake-horse-power Bellis and Morcom engine, to be installed at the Ponoka Asylum.

A glossary of road terms, compiled by H. Percy Boulnois, M. Inst. C. E., and published in serial form in this journal in November and December last, has been issued in book form by the St. Bride's Press, Limited, London, Eng., publishers of The Surveyor, the paper in which the glossary first appeared. There has long been a need for a reliable reference of this kind and the book should be found invaluable by all identified with road construction. The price of the glossary is 2s. net.

The total production of paving brick and paving blocks in Canada in 1912 is returned at 4,579,500, or an average value per thousand of $18.08, as compared with a production of 5,220,400, valued at $79,444, or an average value of $15.22 per thousand in 1911. This paving brick is made chiefly at West Toronto, Ontario, from shale obtained from the banks of the Humber River, although during 1912 a small production was reported at Pender Island, near Vancouver, B.C. The annual production for a number of years has varied from three millions to over five millions a season, and the output is said to claim a market chiefly in Toronto. According to recent returns, about 54 per cent of the production of sewer pipe in 1912 was made in Ontario.

Hydro-Electric Development at Eugenia Falls

In the Contract Record for June 24, announcement was made concerning the award of contracts in connection with the Eugenia Falls hydro-electric development of the Hydro-Electric Power Commission of Ontario. The following detailed particulars concerning the work are of interest:—The development is located on the Beaver River in the counties of Simcoe, Grey and Bruce, about forty miles from Owen Sound, Ont. The plant will be built to take care of the peak load on the transmission system of the Hydro-electric Commission and also to distribute power directly to Owen Sound and surrounding points. Power capacity available for the minimum year of precipitation on record is 3200 h.p.-hr. The commercial capacity, however, will be from 6,000 to 8,000 h.p., according to load factor. The available gross head is 550 ft., and the minimum operating head 510 ft. To increase the output of the station there will be a storage reservoir of 14,000 acre-feet capacity, sufficient to regulate the run-off from the watershed, which is 76 square miles. The dam, which will be 1,955 feet long, with a 105-ft. spillway, will have earth-fill abutments, with puddle cores, aggregating 700 feet. The crest of the spillway is 45 ft. above the foundation, while the dam crest is 5 ft. higher. Originally an earthen dam with a solid concrete spillway was contemplated, but after some months of study an Ambursen dam was determined upon and the contract awarded to the Ambursen Company. The plant will have a short diversion canal, with an intake gate structure of concrete and a 46-in. wood-stave pipe line 3,300 ft. long. At the head of the penstock, which is 50 in. in diameter and 1,500 ft. long, there will be a differential surge tank 100 ft. high. The two generating units will have 2,180 h.p., single runner, Francis turbines running at 900 r.p.m.

The plant is designed and its construction will be supervised by the hydraulic department of the Hydro-electric Power Commission of Ontario under the direction of F. A. Gaby, chief engineer. H. G. Acres is the hydraulic engineer.

Montreal Builders' Exchange

With a view to improving the financial standing of the Montreal Builders' Exchange, the members have decided on an adjustment of the fees. There will be three classes of membership—individual, with a fee of $30; corporate, $20 per capita; and associate, $20, the latter having been increased by $5 per annum. Corporate members are those who are affiliated through their trade organizations, and have all the privileges of individual membership with the exception of the right to vote. This, however, can be obtained by the payment of an extra $10, which places a member on an equal footing with individual members. The change will make no difference in the elective right of the representative of the trade organization on the executive. The fees can be paid in equal half-yearly instalments on July 1st and January 1st instead of making the full payment on the latter date, as at present. Fees will commence at either of the dates named, and there will be no more pro rata fees for those joining between the dates mentioned. The members also gave the executive authority to make an assessment fee, if needed, the basis being a percentage of the annual fee, but this is not to exceed 25 per cent. of the fee during any one year.

Personal Mention

Mr. D. H. Mapes, who recently succeeded Mr. Ellingwood as Superintendent of the Building Construction Department of the C. P. R., is an American by birth, having been born in Munroe, Orange County, N.Y., in 1869. He has been identified with the constructional business throughout his career and has worked his way up from a bricklayer apprentice to his present position. Mr. Mapes has been in entire charge of many fine buildings scattered throughout the New England, New York, and Eastern states. After his apprenticeship he went into the building business with his father in Brooklyn, afterwards organizing the Mapes-Reeve Construction Company, New York. Following this he was superintendent of the Sturgis and Hill Company, New York, and at a later date vice-president of the John V. Schaefer Company, New York. It will thus be seen that he has had a wide experience in the contracting and building lines. He joined the Canadian Pacific in July, 1912, as assistant to Mr. Ellingwood, and when that gentleman resigned was made chief of the department. While in New York, Mr. Mapes was Chairman of the Executive Committee of the Mason Builders' Association, and during the year 1912 was President of the New York State Association of Builders.

Mr. D. H. Mapes, Superintendent of Building Construction, C.P.R.

A Noted British Engineer

Sir Alexander Binnie, consulting engineer, whose advice has been sought upon a number of important municipal enterprises in this country, is the subject of an interesting sketch in the "Civic Engineer's Who's Who," reviewed briefly in another column. Sir Alexander, who is a Londoner bred and born, was engaged early in life on railway work, after which he served for six years in the Indian Public Works Department. For fifteen years he held the position of Water Engineer for the city of Bradford, and during his tenure of that office constructed several large reservoirs, one with an embankment one hundred and twenty-five feet high, at a total cost of some five million dollars; also he laid out for the city an entirely new scheme of waterworks. From 1890 to 1902 he was Chief Engineer of the London County Council and had under his charge the whole of the main drainage of London, including the completion of the sewage-disposal works at Barking and Crossness; and constructed the Barking Road Bridge over the River Lea, the new Highgate Archway, the tunnels under the Thames at Blackwell and Greenwich, and a sewer tunnel under the River Lea. He was continually engaged on the subject of London water supply, appearing on behalf of the Council before various Parliamentary Committees and Royal Commissions; and he prepared the necessary plans and sections for a new water-supply from the River Wye, estimated to cost some ninety million dollars. He is a past-President of both the Institution of Civil Engineers and the Institution of Municipal and County Engineers, a Fellow of the Geological Society, a Fellow of the Meterological Society, and a Member of the Royal Institution. As the author of many valuable professional works he has gained considerable distinction.

Mr. Robert Mitchell has been appointed Building Commissioner of Edmonton, Alberta.

Notes

Mr. Alex. Stewart, assistant chief engineer of the Great Northern Railway, whose death took place at Seattle recently, was a familiar figure in British Columbia. He erected the masonry work at False Creek and the Burrard Inlet dock, and other development work carried out by the Great Northern Railway in Vancouver was done under his supervision.

The danger of sewer gases was illustrated last week at Toronto in the death of Robert Strathearn, an engineer in the employ of the Works Department. The engineer entered the sewer for the purpose of securing levels and proceeded for a distance of about 150 feet, when he was overcome and died before help came. It was the greater part of an hour before his body was recovered. The lives of two men who attempted to rescue him were seriously jeopardized

Mr. H. N. Lymburner, superintendent of Government buildings, Montreal, died suddenly at his home, on July 2. He was 35 years of age.

There has been considerable labor unrest in Montreal. Many carpenters went on strike demanding an advance in wages and an eight-hour day. Prolonged negotiations with the General Contractors Association followed, the result being a concession of 2½c an hour, to 45c, with a nine-hour day. The bricklayers and masons, too, wanted more pay, a 5c an hour rise to 60c an hour, with eight hours a day. The General Contractors' Association also conducted the negotiations. Tentative terms have been arranged under which the men will continue work on the old terms for one year, with an advance of 5c the following year. A nine-hour day is to obtain in the summer and seven or eight hours in the winter.

A $3,500,000 office building is to be constructed at St. Paul, Minn., for the general offices of the Northern Pacific Railway and Great Northern Railway. It will be 290 feet by 232 feet, 13 storeys high with a basement and sub-basement. The building will be of steel frame construction with combination tile and reinforced concrete floor slabs. The exterior finish will be stone for the two lower storeys and brick and terra cotta for the remainder.

Visitors to the Canadian National Exhibition this year will have an opportunity of witnessing hydro-aeroplane flights. Arrangements have been made whereby W. A. Dean will fly his machine daily, starting from the lake and circling over the Exhibition Grounds. These flights will be given at various intervals during the afternoon, but one will take place at the fixed hour of six o'clock every day.

Ten o'clock on Tuesday morning each week is the latest possible hour at which tender advertisements can be received for the issue of the Contract Record published the following day.

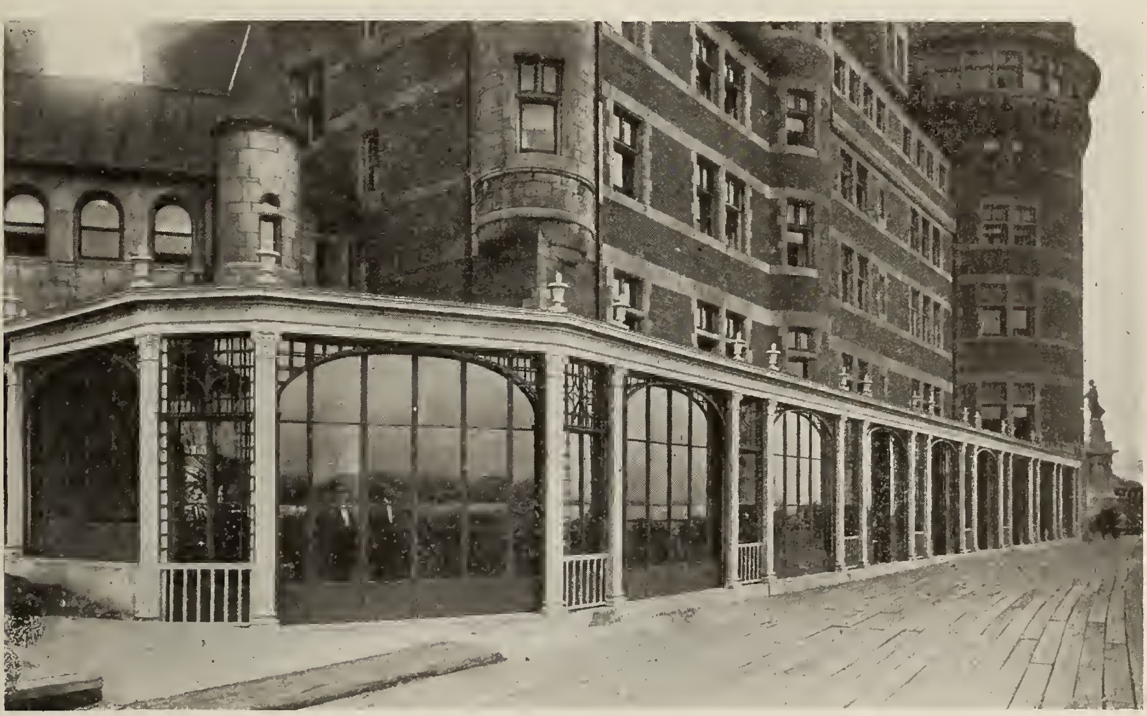
An Expeditious Contract

Among the latest improvements to the Chateau Frontenac, Quebec, is a summer cafe, constructed to replace awnings and to afford visitors protection from the sun and also from unfavorable weather conditions. The doors enclosing the cafe have been specially designed to admit of their being easily and quickly closed in case of a sudden change in the weather, or of a storm, to which the city is subject.

The contract was completed in a very short time. The contracts were not let until April 15 and the cafe was completed and in use on June 1, a period of about six weeks The chief features are the ornamental cast iron columns supporting the roof and the steel glazed doors or sashes closing the space between them. The latter give the maximum amount of light combined with ample strength, a combination impossible had wooden doors been used. The light latticed arches and neat balustrade relieve the monotony of repetition, as do the cast iron urns on the roof breaking the severe lines of the cornices.

The combined weight of the cast iron columns and urns is nearly ten tons. These were delivered on the job inside of two weeks from the time patterns were given to the foundry. Considering the nature of the work this is an unusually short time.

The steel doors, specially designed for this building, operate on the accordian principle and consist of combined sliding and swinging doors, operating, in the large openings, in sets of three in each direction. They are hung on overhead carriers concealed in the cornice and having roller guides in the slotted sill, which is set flush with the cement floor. In the construction of the doors, the stiles, rails, base, etc., are made from solid rolled steel sections. They were carefully cut, coped, mitred and drilled from templates, with all intersections milled to produce perfect joints and ensure the uniformity of the entire number. The joints were then welded by means of the oxy-acetylene process of autogenous welding, which produces a very strong yet invisible connection, making in fact the two members thus actually one piece. There are 90 separate doors, each constructed of twenty-four members, there being approximately 2,200 joints to be welded.



The Chateau Frontenac, Quebec, showing the new summer cafe.

The steel glazing beads were fastened by means of machine screws, and necessitated the drilling and tapping of holes for nearly 5,000 screws. This was accomplished by means of special tapping and drilling machines.

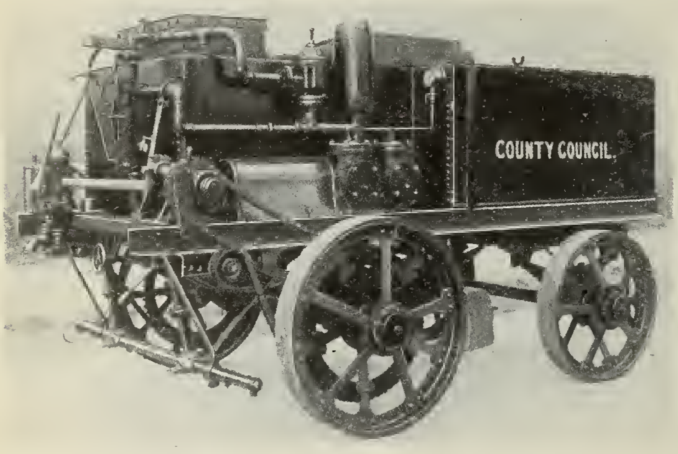
The contract, while not representing a large sum, is of interest from the point of the time in which it was executed and also from the immense amount of detail which it involved. It also shows that metal work can be promptly and well carried out in Canada. The architects were Barott, Blackader & Webster, of Montreal, and the general contractors, E. G. M. Cape, Limited, Montreal, the sub-contractors for the ornamental ironwork being Estey Brothers Company, Montreal.

A Canadian holding company owns the charter for a continuous line of railways in western Canada, covering a distance of approximately 1,250 miles. The line traverses a territory containing coal, timber, oil and various kinds of minerals and also a most productive wheat country. The company has made reconnaissance, route and location surveys costing about $150,000, and has also made accurate estimates of the cost of construction. Bonding powers and government grants considerably exceeding the estimated cost of construction are granted to the company by acts of the Dominion Parliament. The holding company owns several valuable tracts of coal, oil and timber lands and also a number of valuable terminal sites, situated in leading commercial centres. The company wishes to place the whole proposed line under construction immediately and is prepared to treat with capitalists or large contractors who will take the construction bonds at an agreed price and build and equip the said proposed lines according to the plans prepared by the company's engineers. Offers will only be entertained from capitalists or contractors of known standing. Correspondents are therefore required to give full particulars of their name and address in the first instance. Address first correspondence to Canadian Railway Builders, P. O. Box 601, Winnipeg.

Tar-Spraying Road Machinery

The surface treatment of roads under the development of The Taroads Syndicate, Limited (9 Victoria Street, London, S.W., Eng.) is said to have become "a fine art." This company manufactures all classes of tarring machinery and contracts for the tar-spraying of roads and for the construction of bituminous bound roads. Their large tar-spraying machines are capable of treating as much as 20,000 yards super. of road a day. Roads treated for two or three years with these machines show a tar penetration of from two to three inches, and a complete, even distribution is assured. The success of Taroads Syndicate, Limited, has been phenomenal. Their operations have extended year by year until during the season of 1913 six contracts alone out of the large number undertaken represented the spraying of more than six and one-half million square yards, as compared with 344,000 square yards on the same six contracts in 1907. The machines have built up a wonderful reputation by virtue of their rapid dispatch, even distribution and assured penetration. One of the machines purchased by the London County Council is illustrated herewith.

No reference to Taroads Syndicate would be complete without mention of its founder, Sir Herbert B. Mackworth-Praed, Bart., to whom we referred in our issue of July 9th, 1913 (reporting the Third International Road Congress) as "one of the most active members of the General Committee of the London Road Congress." Sir Herbert Praed has accomplished as much for the good roads movement in England as any other single advocate of its claims. He has had a distinguished career and is an ex-member of the British House of Commons. By his initiative and enterprise in the field of good roads he has conferred lasting benefits upon the community. The conquest of the dust nuisance and the construction of roads which will meet the exacting requirements of modern traffic are not the least of his many attainments.



Taroads patented types "B" and "D" tar-spraying machines.

Oil Tractors vs. Auto Trucks

The automobile truck, under ordinary conditions, can make sixty miles a day over country roads, carrying six yards or nine tons of material at a trip. So doing it will make six trips on a ten-mile round trip haul, delivering 36 yards of material.

The 30-60 oil tractor, with a train of reversible engine wagons, will make two round trips on a ten-mile haul, carrying about 27 yards at a trip or 54 yards during the ten hours.

The automobile truck, with its tire construction, is especially adapted for use in the city on level pavements, while the tractor and wagon outfit is built for hard usage over rough roads and is less liable to break down under those conditions than the auto truck.

The cost of the wearing parts on the auto truck is about three times the cost of the wearing parts of the tractor and wagon outfit. The first cost of the automobile truck is much in excess of the cost of the oil tractor and wagon outfit, while the former will accomplish only about two-thirds of the work of the tractor and wagons.

A high speed truck constructed for use on smooth streets is entirely practicable in the city, but on the average country road different conditions are to be contended with and a practical hauling outfit must be constructed to meet those conditions. The contractor should consider carefully the type of equipment that will accomplish most for the money invested and that will cost the least to maintain.

Tiffin Motor Trucks, manufactured by the Tiffin Waggon Company, Tiffin, Ohio, are carefully described and well illustrated in a booklet just to hand. These trucks have earned a reputation for stability and for the absence of a single weak link in their entire construction. The Tiffin Company's long experience in building heavy duty vehicles has culminated in a motor truck that will stand no end of abuse, both in operating and loading. The trucks are built in three chassis models of fifteen hundred pounds, one ton and two tons. From all standpoints the company believe that they have evolved the most practical truck design of to-day. The trucks sustain the reputation which the firm have already made with their municipal and sanitary vehicles, sprinklers, automatic flushing machines, dumping wagons, and steel bucket street cleaning and garbage trucks.

The Marsh-Capron Manufacturing Company, Chicago, have issued in their catalogue of M-C Rail-Track Mixers a well-illustrated publication which will enable the contractor to select readily the size of mixer, kind of power, loading device, etc., best suited to his work. The company claim for their machine that it ensures "most mixing with least fixing"—a statement which would appear to be substantiated by a study of the constructional details which are illustrated to much advantage in the catalogue. The combined mixers and hoists shown in the catalogue have been developed to meet the requirements of contractors using concrete which has to be elevated to the upper floors of a building, bridge decks, or other structures of the kind.

A "Civic Engineer's Who's Who" has been compiled by the Editor of the London "Surveyor" and is published by the St. Bride's Press, Limited, Fleet Street, London, England. This interesting publication is a most valuable key to the personnel of the engineering profession in the Old Country and cannot fail to be well received by all whose work has identified them with their confreres in the "tight little island." The sketches are breezy and get away from the stereotyped character of most biographical material.

Bulletin B 7, just issued by the Herbert Morris Crane & Hoist Company, Limited, is devoted exclusively to the Morris type S 1 hand-operated overhead travelling crane, which is a very light crane, designed in various sizes up to 1½ ton. By making all the main parts of rolled-steel sections the weight of the crane itself has been kept very low, thus avoiding that disproportion between the dead weight and the live or useful weight which is so often a discouraging feature. The bulletin describes a large number of alternative constructions of the lifting gear, which are available for use under the varying conditions found in the many factories in which this type of crane can be used to advantage.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Banff, Alta.
Tenders will be received by Lyndwode Pereira, Secretary to the Department of the Interior, Ottawa, until noon July 27th, for laying and jointing about 13,000 lin. ft. of 20-in. diam. lap welded steel water pipe. Plans and specifications are with the Commissioner of Dominion Parks, Ottawa, Chief Superintendent of Dom. Parks, Edmonton: Supt. of Rocky Mountain Park, Banff.

Cartierville, Que.
Tenders will be received by the Mayor until 6 p.m. July 17th, for the construction of permanent walks, drains, etc. Plans and specifications are at the office of F. A. Laberge, C.E., 30 St. James St., Montreal.

Calgary, Ont.
A by-law will shortly be submitted to the ratepayers for the construction of a subway on 4th street. The estimated cost is $98,000.

Crowland Twp., Ont.
Tenders for the construction of concrete sidewalks on Muir St. and Ontario Rd., will be received until noon July 18th, by the township clerk, H. L. Pratt, Welland. Specifications are at the offices of the engineer, Geo. Ross, Welland.

Edmonton, Alta.
The City Commissioners are open to receive tenders for two single stage, vertical spindle centrifugal pumps, each capable of delivering 600 gals. of screened sewage per minute, two automatic starters and float switches for 30 h.p. motors, two 4-in. and 2 6-in. flanged stop valves. Specifications are with the engineer, A. J. Latornell, Civic Block.

Fairville, N.B.
The Parish of Lancaster Highway Board has awarded to Murray W. Long, Fairville, N.B., the contract for the construction of concrete sidewalks on Main street.

Hamilton, Ont.
The following contracts for sewer construction have been awarded by the city council: J. J. Armstrong & Sons, London Street, $800; Rosslyn Ave., $1,100. City Engineer, Barton Street, $1,190, Main Street, $859.

Hamilton, Ont. (Dundas)
Surveys for the construction of sewers and water mains have been made by the town council. T. Aird Murray and T. Low, of 186 King Street W., Toronto, are the engineers.

Hull, Que.
Tenders will be received by the clerk to the city council until July 20th, for the construction of watermains throughout the city. A certified cheque for $2,000 will be required.

London, Ont.
The city council has surveyed Dundas street with a view to the construction of vitrified brick pavement from Talbot street to River Thames. Engineer, Wm. N. Ashplant.

Listowel, Ont.
Plans for a reservoir are being drawn for the town council. Bowman & Connor, of 16 King St. W., Toronto, are the engineers in charge of the work.

Moose Jaw, Sask.
The city council has awarded to the National Paving & Construction Company, of Winnipeg, the contract for the construction of 19,000 sq. yds. asphaltic concrete No. 1 at $2.60 per sq. yd.

Medicine Hat, Alta.
On July 24th the city council will submit to the ratepayers by-laws providing for the construction of cement sidewalks, curbs and gutters at an estimated cost of $150,000.

Montreal, Que.
Surveys have been made with a view to the construction of a subway under the C. P. R. tracks on Park Ave., at the corner of Van Horne Ave. Tenders to be called shortly by the Board of Commissioners. The estimated cost is $190,000.

Nanaimo, B.C.
A by-law has been passed by the city council providing for extensions to the sewerage system. The town clerk is S. Gough.

Ottawa, Ont.
The city council proposes to lay asphalt pavement on Cambridge street between Laurier and Primrose streets.

Toronto, Ont.
Tenders will be received by the chairman of the Board of Control until noon, July 21st for the construction of asphalt pavements on 6 streets, bitulithic on 2 streets, brick block on 3 streets, concrete on one lane, concrete curbings on 2 avenues, and for concrete walks on 18 streets. Specifications are at the office of the Commissioner of Works, City Hall.

The following contracts for the construction of sidewalks have been awarded by the township of York for Glenholme and Lauder Avenues, Grant Contracting Co., 50 Front St. E., at $3,800 and $980 respectively. For Day Ave., John Walker, Scarboro, Ont., $446. For Millerson Ave., Routly & Summers, 47 Belamond Ave., $270. For Jane St.,

CONTRACTS AWARDED

Gloucester Twp., Ont.
The contract for the construction of the drainage system has been awarded by the township council to Thos. Flemming of Ottawa.

Lachute, Ont.
The municipal council has awarded to the local firm of Lafleur & Berniquer, the contract for the construction of macadam roads.

McKillip Twp., Ont.
The township council has awarded the following contracts, to A. Hicknell, of Winthrop, for the construction of the Barron drain at $1,000, and to L. Looby, for the construction of the retaining wall at $5.80 per cu. yd. and the drain bridge.

Nanaimo, B.C.
The city council has awarded to H. J. Kaiser, of 1601 Comox St., Vancouver, the contract for the laying of 100,000 sq. yds. asphaltic concrete or bitulithic paving on 13 streets.

Regina, Sask.
The following contracts have been awarded by the city council (Waterworks Dept.) in connection with the construction of the new reservoir. Steel reinforcement, Drummond McCall & Co., 334 Somerset Bldg., Winnipeg, at $9,233.50; Peart Bros. Hardware Co., Ltd., Dewdney St., at $928.20.

The Canada Cement Co. of Calgary has secured from the waterworks department a contract for the supply of 6,000 barrels of cement.

Thorold, Ont.
The town council has awarded a contract to the Asphaltic Concrete Co., Ltd., of 74 King E., Toronto, for the construction of rocmac pavement on Pine street, at $1.60 per yd.

Toronto, Ont.
The following contracts for sewer construction have been let by the Board of Control. Jennings & Ross, 79 Spadina Ave., Alton Ave.; Davies & Newton, Berkeley Place, $510.50, Williamson Rd.; W. E. Taylor, 438 Clinton St., Florence Ave., $1,687, Humberside Ave., $438, James Place, $338, North Place, $268, and street 1st north of College St., $787; M. H. Murphy, 84 Dominion St., Hammersmith Ave., $1,268, lane 1st east of Church St., $876, lane 1st west of Yonge; Wilks & Wallace, 405 Manning Ave., lane 1st west of Roncesvalles, $385; Commr. of Works, lane 1st north of Springhurst Ave., $410, lane 1st west of Yonge St., $370.

The Board of Control has awarded the following contracts for the construction of pavements and sidewalks. Asphalt pavements on 8 streets to Commr. of Works; asphaltic concrete on 1 street to Commr. of Works; concrete curbings on 4 streets to Commr. of Works; concrete walks on Ashbridge, Berwick, Buckingham, Carlaw, Dartford, Dawlish, Dinnick Cres., Dundurn, Linsmore (2 sides), Lytton, Melgund, Mona, Oriole, Parkway, Queen Rochester, Sidmouth, Strange, St. Leonards Ave., Tennis Cres. (2 sides), Commr. of Works; Riverdale Concrete Paving Co., 256 Jones Ave., Bathgate Ave. (2 sides); A. Gardner & Co., 52 Strange St., Danforth Ave.; Britnell Contracting Co., 209 Davenport Rd., Glebholme Blvd. (2 sides), 4 contracts; H. Mitchell, 464 Brock Ave., Milverton Blvd. (2 sides); Jos. Payne, 43 Melville Ave., Paton Rd.; Wm. Bushell, 168 Dundas St., Strathmore Blvd. (2 sides) 4 contracts; Queen City Concrete Paving Co., 179 Broadview Ave., Greenwood Ave.

New Toronto, Ont.
The town council has awarded a contract to Walter Buckhurst, of 13 Bartlett Ave., Toronto, for the construction of concrete walks on Lakeshore Rd., 5th and 15th Sts. The contract for laying the intake pipe has been secured by J. Curley, of 24 Adelaide St. E., Toronto.

Vancouver, B.C.
The contract for the paving of Third Street has been let by the city council to H. J. Kaiser, 1601 Comox St., at $1.40 per sq. yd. The material to be used is asphaltic macadam.

Welland, Ont.
The town conucil has awarded the following contracts for sewer construction. A. D. Brown, on Victoria St., at $262; Somerville & Reid, on Evan St., at $814, and to J. G. Mills, of Oakville, on Bald St., at $842.26.

Railroads, Bridges and Wharves

Prov. of Alberta
Tenders will be received by Jno. Stocks, Department of Public Works, Edmonton, until July 20th, for the erection of a stock pavilion and class room for the Agricultural Schools at Claresholm, Olds and Vermillion. Plans and specifications are at the office of the Architect, Dept. of Public Works, Calgary, and at the Agricultural Schools named.

Brockville, Ont.
The county council has instructed the county engineer Blackwell to prepare plans and specifications for the construction of a concrete bridge near Brockville.

Calgary, Alta.
A new by-law is to be submitted to substitute a concrete structure for the iron bridge authorized by ratepayers to be erected over the Bow River at 9th St.

Dunnville, Ont.
The Lake Erie & Ontario R. R. has plans in progress for the erection of a station of hollow tile construction.

Ft. Frances, Ont.
Tenders will be called shortly by the Public Works Department, Ottawa, for the construction of a dock. The estimated cost is $5,000.

Miniota, Man.
Tenders will be received by the secretary-treasurer, W. E. Warren, until July 20th, for the construction of a concrete bridge between Secs. 3 and 4, 13-27 W. Plans and specifications are at the Municipal Hall.

Montreal, Que. (Point St. Charles)
Tenders will be received by L. N. Senecal, secretary to the Board of Commissioners until noon, July 21st, for the furnishing and laying of a concrete encased steel pipe conduit at the low level pumping station, Point St. Charles. Plans and specifications are at office of the Superintendent of Waterworks, City Hall, Montreal.

New Westminster, B.C.
The Great Northern Railway Company is ready to build a station here and has asked the city's support in securing the lease of a site from the provincial government.

Negropoint, N.B.
Tenders for extensions to the breakwater will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 26th. Plans, etc., are at the office of Dist. Engrs. at St. John, N.B., Halifax, N.S., Post Office, Quebec, Que., Shaughnessy Bldg., Montreal, Confed. Life Bldg., Toronto, Ont., Postmaster, St. John, and at the Department, Ottawa.

Steveston, B.C.
Tenders will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 11th, for the construction of Sec. No. 2, of the jetty, at the mouth of the Fraser River. Plans, etc., are at the offices of the district engineers, New Westminster and Victoria, Postmaster, Steveston, and at the Dept., Ottawa. The jetty is to be built of tiers of mattresses and rock. The bottom or apron mattress is to be 190 ft. wide, 95 ft. on each side of the entire line of jetty. The total length is 7,100 ft. The estimated cost of the project is $750,000.

St. Valier, Que.
Tenders for the construction of certain extensions to the wharf will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m., July 30th. Plans, etc., are at the offices of the District Engineers, Montmagny, Que., Post Office Building, Quebec, with Postmaster, St. Valier and at the Department, Ottawa. The proposed work consist of a close-faced timber cribwork filled with stone ballast.

CONTRACTS AWARDED

Cambridge and Cumberland Twps., Ont.
The local council has awarded to the Ontario Bridge Company, of Crown Office Bldg., Toronto, the contract for the construction of a steel and concrete bridge.

Twp. Glenelg, Ont.
The bridge contract has been awarded by the township council to David Keys, of Kincardine.

Hatfield, Point, N.B.
The Public Works Department has awarded to Wm. R. Fawcett, of Temperance Vale, N.B., the contract for the construction of the wharf.

Toronto, Ont.
The contract for the construction of the new Union Station has been secured by the P. Lyall & Son Construction Co., of Montreal. The Toronto office is 201 King street west.

Wellington Co., Ont.
The following contracts for bridge construction have been awarded by the county council. (a) J. Goffney, of Kennicott, Ont., for Mallett Bridge; (b and e) J. Tieker, of Harriston, Sinclair's and O'Dwyers Bridges; (c) H. Croft, of Guelph, Saigon Bridge; (d) E. Simmons, of Drayton, 12 ft. concrete slab bridge.

Public Buildings, Churches, Schools, etc.

Prov. of Alberta
Tenders are called by the Prov. Govt. Dept. of Public Works for the erection of stock pavilion and class room for the Agricultural Schools at Claresholm, Olds and Vermillion. Plans and specifications are at the office of the provincial architect, Parliament Bldgs. Edmonton.

Ashcroft, B.C.
Tenders for the erection of a public buildings will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 4th. Plans, etc., are at the office of Mr. Wm. Henderson, Res. Arch., Victoria, Post Office, Ashcroft, and at the Dept., Ottawa.

Brampton, Ont.
The purchase of school fittings is contemplated by the Public School Board.

Brighton, Ont.
New tenders for the erection of a 12-room brick school building close with E. C. Brown, secretary of the School Board and with the architects, Ellis & Connery, Manning Chambers, Toronto, July 18th.

Beauport, Que.
Tenders for the erection of the post office are in, but no action has been taken in regard to same.

Birch Hill, Sask.
Plans have been drawn for the erection of a Public and High School, at an estimated cost of $12,000. The building will be of stone and brick veneer construction and will contain 4 rooms.

Boissevain, Man.
Tenders for the erection of a public building will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. July 30th. Plans, etc., are at the office of H. E. Matthews, Res. Arch., Lindsay Bldg., Winnipeg, Postmaster, Brandon, Post Office, Boissevain, and at the Dept., Ottawa.

Carberry, Man.
Tenders for the erection of a post office will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. July 30th. Plans, etc., are at the office of H. E. Matthews, Res. Arch., Lindsay Bldg., Winnipeg, Postmaster, Brandon, Post Office, Carberry, and at the Dept., Ottawa. The estimated cost is $30,000.

Courtenay, B.C.
Tenders for the erection of a public building will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 5th. Plans, etc., are at the office of Mr. Wm. Henderson, Res. Arch., Victoria, Post Office, Courtenay, and at the Dept., Ottawa.

Elkhorn, Man.
Tenders for the erection of a public building will be received by R. C. Desrochers, secretary to the Public Works

Department, Ottawa, until 4 p.m. July 31st. Plans, etc., are at the office of H. E. Matthews, Supt. Arch., Dominion Public Bldgs., Winnipeg, Post Office, Brandon, and at the Dept., Ottawa.

Edmonton, Alta.

Tenders for the erection of the new R.C. Cathedral will be received by the Architect, R. W. Lines, Canada Permanent Bldg. ,until noon, July 30th.

Ford City, Ont.

It is understood that the town council has postponed indefinitely the building of the proposed town hall.

Gimli, Man.

F. R. Evans, architect, of 506 Somerset Bldg., Winnipeg, has drawn plans for the erection of a school building for the School Board.

Grenfell, Sask.

The secretary to the Methodist Church, Mr. W. H. Thompson, will receive tenders for painting and interior decoration.

Hespeler, Ont.

New tenders for the erection of the town hall will be received by the town clerk, Winfield Brewster, until August 4th. Evans & Fulford, of Galt, are the architects.

Hamilton, Ont.

It is understood that the contracts for alterations and additions to the Barton Street Hospital are not yet awarded.

London, Ont.

The erection of a new building is contemplated by the Western University Trust. Further information can be had from C. R. Somerville, 336 Piccadilly, and T. J. Murphy, Dundas St.

McBride, B.S.

Tenders will be received by the Hon. Thos. Taylor, Public Works Department, Victoria, until July 29th, for the erection of a lockup and constables' quarters.

Medicine Hat, Alta.

A by-law, providing for the purchase of a site and the erection of a police station at a total cost of about $45,000, will be submitted to the ratepayers on July 24th. The building is to be a two-storey one of brick construction.

Montreal, Que.

The R. C. School Commissioners have decided not to proceed with the building of the St. Mark School this year.

Niagara Falls, Ont.

Tenders for the erection of the new Baptist Church on Jepson street will be received by A. R. Lydeard, 34 Clark St., until noon, August 8th. Plans and specifications are at South Bros.' furniture store, Park street.

Oak Lake, Man.

Tenders for the erection of a public building will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 4th. Plans are at the office of H. E. Matthews, Supt. Arch., Dom. Public Bldgs., Winnipeg, Post Offices at Oak Lake and Brandon, and at the Dept., Ottawa.

Ottawa, Ont.

Tenders for the erection of an office and dressing rooms at the Exhibition Grounds will be received by the secretary to the Central Canada Exhibition Assn., 26 Sparks St., until July 14th.

Plans for additions to the court house on Nicholas Street, have been drawn by C. J. Burritt, Booth Bldg., Sparks Street. The basement is to be altered, an additional wing erected, a steam heating system to be installed, and general decorative repairs to be carried out.

Point Grey, B.C.

A permit has been granted to the School Board for the erection of a school building at the corner of 25th Avenue and Collingwood Street, at an estimated cost of $11,000.

Prince Rupert, B.C.

The time for receiving tenders for the erection of the Post Office has been further extended to Saturday, August 1st.

Qu'Appelle, Sask.

Tenders for the erection of a drill hall will be received by the Director of Contracts, Dept. of Militia & Defence, Ottawa, Ont., until noon July 28th. Plans and specifications are with the Officer Commanding Military Dist. No. 10, Winnipeg, Man., Town Clerk, Qu'Appelle, and Director-General of Engineer Services, Headquarters, Ottawa.

Regina, Sask.

The city has secured an 80-acre site for the proposed construction of an abattoir and stock yards.

Toronto, Ont., Fairbank

It is proposed to rebuild St. Hilda's Anglican Church with brick. The vicar is the Rev. H. R. Young.

Toronto, Ont.

Tenders addressed to the secretary-treasurer of the Board of Education will be received by the Advisory Industrial Committee of Board until noon, July 22, for part of the equipment for the new technical school on Lippincott Street. The contract is to be let in two parts. Plans and specifications for the first part are at the office of Architects, Ross & Macdonald, 828 Traders Bank Building, and plans and specifications for the 2nd part at the office of the engineers, Canadian Domestic Engineering Co., Ltd., 47-51 King St. W.

Tenders for all trades in connection with the erection of the registry office on Elizabeth Street, will be received by the architect, Chas. S. Cobb, 71 Bay St., until July 21st.

Westboro, Ont.

The erection of a stone church with a seating capacity of 500 is proposed by the congregation of All Saints Anglican Church.

Windsor, Ont.

Tenders for the erection of a pavilion on the river front will be received by the chairman of the city council until July 21st. The estimated cost is $6,175.

The members of the Windsor Lawn Bowling Co. propose to erect a new club house.

Winnipeg, Man.

Jno. D. Atcheson, architect, Trust & Lion Bldg., is preparing plans for the erection of a hall and lodge room on Donald and Graham streets, for the Ancient Order of Foresters. The estimated cost is $75,000.

Yorkton, Sask.

The town council proposes to erect and equip a fire hall at a total estimated cost of $27,500. The proposal will be embodied in a by-law which will be submitted shortly.

CONTRACTS AWARDED

Brockville, Ont.

The contract for the erection of the Brockville Country Club House has been secured by Ed. Parslow and E. A. Horton.

Cupar, Sask.

The School Board has awarded the contract for school extensions to the contracting firm of Poole & Emery, of Moose Jaw.

Cobalt, Ont.

The Public School Board has awarded to Tully Barton, the contract for school alterations.

Fort Saskatchewan, Alta.

Johnson & Coughlin, of Camrose, have secured the contract for the heating and plumbing of the new jail.

Medicine Hat, Alta.

The city council has awarded the following contracts in connection with the creation of comfort stations on First street. Olson & Johnson, McLeod Blk., for construction, at $7,400; heating and plumbing, Sommerville Hardware Co., at $2,890.35.

Montreal, Que., Verdun

The following contracts have been let by the town council in connection with the erection of the fire station on Osborne street. General contractors, D. G. Loomis & Sons, 1112 St. Patrick St.; heating and plumbing, Conroy Bros., 291 Centre St.

Montreal, Que., Victoriatown

The contract for alterations to the St. Alphons convent has been let to Jas. Shearer & Co., 225 St. Patrick St., Montreal.

Ottawa, Ont.

H. A. Knox, of Elgin St., has secured the contract for the heating of the new Howick Hall on the exhibition grounds.

Portage la Prairie, Man.

The Department of Indian Affairs has awarded to the Brown Construction Company, of Winnipeg, the contract for the construction of a boarding school The work is to start immediately.

Port Robinson, Ont.

The contract for the erection of St. Paul's Guild Hall has been secured by A. G. Pettit, of Welland.

Quebec, Que.

The following contracts have been awarded on the erection of "Mallet" Academy: Masonry, carpentry, steel and plastering, Magloire Cauchon, 307 Richardson Street; roofing, Eugene Falardeau, 143 Dorchester Street; painting, J. M. Tardivel, 4 Abraham Hill; heating, plumbing and electrical, Fortunat Gingras, 36 St. Augustin Street.

St. John, N.B.

The contract for painting the exhibition building has been secured by Jas. Pullen, Horsefield street.

St. Timothee, Que.

The Municipality of St. Timothee has

awarded to M. Octave Dorais, the contract for the erection of a school building.

Truro, N.S.
The following contracts have been awarded by the provincial government on the erection of the Science Building on Bible Hill. Masonry and carpentry, W. K. McDonald, 396 Tower Road, Halifax; heating, plumbing, ventilating and electric wiring, Farquhar Bros., 16 Barrington St., Halifax; painting, David Roche, 238 Argyle Street, Halifax.

Toronto, Ont.
The following contracts have been awarded by the Separate School Board: Queen City Concrete Paving Co., Ltd., 179 Broadview Ave., concreting, at $193. A. B. Ormsby Co., Ltd., King St. W., galvanized iron at $540. D. Glynn & Son, 156 Arthur St., plumbing at $821; J. W. Morgan, 210 Parliament St., painting and kalsomining (east section) $1,551; A. Richard, 403 Spadina Ave., painting and kalsomining (west section), $1,065.

The contract for interior fitting in connection with the erection of Niagara Street school has been awarded by the Board of Education to Orr Bros., Queen Street East.

West Toronto, Ont.
The contract for masonry and carpentry in connection with the erection of the Church of the Advent has been let to G. T. Lea, of 579 Indian Road, Toronto.

Vancouver, B.C.
The contract for the erection of the old peoples' home near Boundary Road and Union Street has been awarded by the city council to Perry & Fowler, of the Pacific Bldg.

Victoria, B.C.
The contract for the erection of the Connaught Seamen's Institute building has been secured by Knott & Jones, of 1327 Pandora street.

Business Buildings and Industrial Plants

Fort George, B.C.
The erection of a steam laundry on Fraser avenue is proposed by P. C. Shackleton, of Calgary.

Hamilton, Ont.
The Diamond Flint Glass Company are contemplating the erection of a pattern storage building on Chappell Ave. The building is to be fireproof and brick construction.

Joliette, Que.
It is understood that the Royal Bank of Canada will shortly erect a branch office here.

London, Ont.
Plans for the erection of a store and apartment building, at the corner of Maitland St. and Cheapside, are being drawn by Watt & Blackwell, Bank of Toronto Bldg. The estimated cost is $8,000.

Lacombe, Alta.
The erection of a store and billiard parlor is being considered by Messrs. Creigen & Davie.

Montreal, Que.
Patterson Mfg. Co., 2021 St. Hubert St., are receiving tenders for the erection of a factory on St. Hubert St., at an estimated cost of $25,000.

Tenders for general contractor and separate trades in connection with the alterations and additions to the premises of Jas. M. Curd, St. Urbain St., will be received by the architects,, Gordon & Aird, Stanley St.

Montreal, Que. (Westmount)
Plans for the installation of an artificial ice plant are being drawn for the Montreal Arena Company.

Montreal, Que., St. Lambert
A site for the erection of a factory has been purchased by the Carters Ink Co., of Cambridge, Mass., U.S.A.

Prince Rupert, B.C.
Messrs. M. Albert & Geo. A. Sweet are considering the erection of a large hotel. It is proposed to provide at least 100 rooms.

Saskatoon, Sask.
MacDonald's Consolidated have purchased a site on the west side of First avenue for the erection of a grocery warehouse.

Toronto, Ont.
Plans for the erection of a planing mill at Davisville have been drawn by James, Louden & Hertzberg, Adelaide and Church Sts., for R. W. E. Burnaby. Tenders are not yet called.

Tenders on all trades in connection with the erection of 2 stores on Dovercourt Road are invited by the owner, C. S. West, who has plans at his office 975 Bloor Street West.

Windsor, Ont.
Plans are being drawn for the erection of a warehouse by C. W. Cadwell, 135 Ouellette Ave. The estimated cost is $10,000.

Welland, Ont.
R. Moore & Son, 14 Main St. W., have purchased a site on Cross and Division streets for the erection of a business block.

Westbridge, B.C.
The White Pine Lumber Co., of Spokane, U.S.A., proposes to erect a sawmill about 30 miles from Greenwood. The mill is to have a capacity of 200,000 feet of lumber per diem.

CONTRACTS AWARDED

Hamilton, Ont.
The following contracts have been awarded in connection with the erection of the Howell Lithographing Company's warehouse on Vine St. Masonry, Geo. E. Mills, 614 King St. E.; carpentry, D. Tope & Sons, 187 Robinson St.; roofing, J. E. Riddle & Son, Ferguson Ave. N.

Ottawa, Ont.
The contract for the erection of a picture theatre on Wellington St. for Frank Jarman and others, has been secured by Chas. Hopewell, 7 Clemow Ave.

Residences

East Angus, Que.
The proposed residence of J. A. Planche, will not be built this summer.

Berlin, Ont.
Geo. Steinmetz has purchased a site on Queen street south for the erection of a store and residence.

Guelph, Ont.
It is understood that the residence for W. A. Russell, Wellington Place, will not be built this year.

Hamilton, Ont.
Nothing further will be done at present in regard to the proposed erection of a residence on Eastbourne Ave. for Mr. E. Todd.

The erection of an apartment house in the East End by a client of Geo. T. Evans, Bank of Hamilton Bldg., has been postponed until the spring.

Lambeth, Ont.
J. Ross has decided not to proceed with the plans for the erection of a $5,000 bungalow.

Montreal, Que., Outremont
Nothing further will be done in regard to the proposed erection of two large residences on Ainslie Street by E. Ouellette and R. Tourville.

Montreal, Que., Westmount
Plans are being drawn for alterations to the residence of R. A. Webster, and tenders are invited by the architect, J. H. McDowell, Drummond Bldg.

Tenders for all trades in connection with the erection of two residences on Avenue Rd., for T. P. Howard, are invited by the architects, Nobbs & Hyde, Old Birks Bldg.

Ottawa, Ont.
J. Cloutier proposes to erect a residence on Chapleau street.

The erection of a residence on Mary street is being considered by F. Lenton, Centre street. The estimated cost is $5,000.

Howe & Ewans of 377 Somerset St., contemplate the erection of a residence on Fairbain Street.

The erection of a $5,000 residence on Main street is proposed by McDairmid & Tyndall, 652 Gilmour.

Jacob Rubin, 145 Coburg St., proposes to erect a residence on Clarence street at a cost of $5,000.

The erection of a residence on Marlowe street at a cost of $6,000 is being considered by Chas. R. Nicholas, 589 McLeod.

G. A. Clark, 106 Kent St., proposes to erect a residence on Melgund St., at an estimated cost of $5,000.

Point Grey, B.C.
A permit for the erection of a residence at a cost of $8,000 has been granted to E. E. Crandall, 1052 Homer St., Vancouver.

Regina, Sask.
Tenders for the erection of a $10,000 residence on Wascana Park will be received by the architects. Clemesha & Portnall, 1 Credit Foncier Bldg.

Nothing will be done this year in regard to the erection of the apartment block at the corner of 13th and Halifax streets for Mr. H. Dutton.

A permit for the erection of a residence on Princess street, at a cost of $6,000, has been granted to A. R. McKay.

Toronto, Ont.
A permit for the erection of a detach-

ed residence on Williamson Road has been issued to E. J. Howson, 63 Kingswood Road.

Plans for the erection of two residences on Awde Street have been drawn by Davis & Moore, 176 St. Clarens Ave.

Plans are being drawn for the erection of a $10,000 residence on Glencairn Ave., for J. L. Thorne, 1315 Traders Bank Bldg.

Victoria, B.C.

A permit for the erection of a residence on St. Charles St., at a cost of $14,000, has been granted to W. A. Irish.

Plans for the erection of an apartment house of 18 suites are being prepared by Rockfort & Sankey, 505 Union Bank Bldg.

Winnipeg, Man.

No contracts have been yet awarded in connection with the erection of an apartment block for M. Denis, and it is understood that the work has been postponed until next year.

Hunt & King, 253 King Edward St., propose to erect two residences on Manderville Avenue at a cost of $7,000 and $6,500 respectively.

The erection of a $11,500 residence on Casey and Oakwood streets is proposed by J. H. Simmons, 275 Oakwood Street.

D. E. Campbell, 301 McArthur Block is about to erect a residence on Hampton street at a cost of $5,000.

The erection of a residence at the corner of Young and Berrester streets, at an estimated cost of $5,000, is contemplated by D. D. Wood.

D. E. Campbell, 301 McArthur Block, proposes to erect two residences on Ferry Road, at a cost of $10,000.

Windsor, Ont.

The erection of a 4-family flat, at an estimated cost of $25,000, is being considered by H. Wilson.

Emery & McCririe, Medbury Bldg., are the architects for a proposed 2-family flat for Mrs. D. E. Emery.

CONTRACTS AWARDED

Brockville, Ont.

The contract for alterations to the residence of W. A. White on North Augusta road has been awarded to W. Gray.

Hamilton, Ont.

The contract for additions and interior alterations to the residence of Wm. Hendrie, Aberdeen Avenue, has been secured by Donaldson & Patterson, 229 Bay Street South.

Ottawa, Ont.

The contract for the erection of a residence on Henderson Street, for Mrs. P. A. Gauthier, has been let to L. Gauthier, 285 5th Avenue.

Toronto, Ont.

The contract for the erection of a residence in St. Andrews Gardens for Sidney Smith, has been let to Wm. Edwards, 281 Howland Ave., who will sublet all trades but masonry.

Power Plants, Electricity and Telephones

Hamilton, Ont. (Dundas)

An addition is to be built to the town hall for a transformer station. The building will also be remodelled for offices.

Lucan, Ont.

The purchase of a hydro equipment is contemplated by the town council. Further information can be had from Mr. Geo. Stanley.

Renfrew, Ont.

The ratepayers will vote to-day on the proposal to install an electric lighting system at a cost of $16,000.

Regina, Sask.

Storey & Van Egmond, architects, McCallum Hill Bldg., invite sub-tenders for plumbing in connection with the erection of the new power house.

Winnipeg, Man.

Tenders for the supply of 16,000 ft. lead covered paper and rubber insulated cable are called by the Board of Control.

CONTRACTS AWARDED

Assiniboia, Sask.

The Assiniboia Rural Telephone Co., Ltd., has awarded to W. D. Craig, of 2276 Cornwall Street, Regina, a contract for the supply of material and the construction of a telephone system.

Kelowna, B.C.

The municipal council has awarded the following contracts for electrical apparatus. Robt. Hamilton & Co., Vancouver (agents for Goldie & McCulloch, Galt, Ont.), engine at $3,810; condenser, $626; heater 400 h.p., $27. Canadian General Electric Co., 1065 Pender St. W., Vancouver, generator and exciter 200 kw., $2,635. Canadian Westinghouse Co., Ltd., Hamilton, Ont., switchboard panel, $400.

Montreal, Que. (Westmount)

The following additional contracts for electrical supplies have been awarded by the town council: Northern Electric Mfg. Co., 814 Notre Dame W., Montreal, 1,200 nitrogen filled tungsten lamps, $4,099; Canadian General Electric Co., 162 St. Antoine St., Moutreal, 6 regulating transformers $3,580.

Regina, Sask.

A contract has been awarded by the city council (Light & Power Dept), to Crane & Ordway, of 93 Lombard St., Winnipeg, for the supply of piping and valves for the new power house.

The city council (St. Rly. Dept.) has awarded to United Steel Products Ltd., 402 Trust & Loan Bldg., Winnipeg, the contract for the construction of one single track intersection, 3 part wye, with crossover at the north end of Broad St. Subway.

St. John, N.B.

The authorities of the St. John City & County Municipal Home have awarded to Frank E. Jones, Prince William St., the contract for the installation of an electric lighting system.

Winnipeg, Man.

The Board of Control has awarded a contract to the Canadian British Insulated Co., Ltd., of 83 Craig St. W., Montreal, for the supply and laying and jointing of 5,500 ft. 3 core paper insulated, lead covered 13,000 volt cable at $1.27 per ft.

Welland, Ont.

The town council has awarded to the Turbine Equipment Company, Limited, of Toronto, the contract to supply and install two 2½-million gallon DeLaval single-stage double-suction centrifugal pumps; each pump is to operate against a pressure of 170 ft.; they will be direct connected to 125 h.p. Canadian Crocker Wheeler induction motors.

Miscellaneous

Brussels, Ont.

P. Ament is in the market for the purchase of a stave mill equipment.

London, Ont.

John Putherbough, 1006 Wellington St., requires 850,000 yellow bricks f.o.b. London.

Municipalities

and others sending in tender advertisements for the Contract Record are requested to bear in mind that these must be in our hands by

Ten o'clock on Tuesday morning,

each week, in order to be published in the issue of the following day.

MacLean Reports tell you where the projects are that interest you and in what course of construction they are on the day reported. You know at exactly what stage of the work to approach the buyer. You are able to reduce the percentage of wasted time and lost orders by concentrating on the most likely opportunities. Use **MacLean Reports** to know all the opportunities. Rates and samples on request.

MacLean Daily Reports Limited

220 King St. West - TORONTO

Tenders and For Sale Department

Notice to Contractors

Billings Bridge

Sealed tenders addressed to the Secretary of the Board of Control, City Hall, Ottawa, will be received up to 4 p.m., **July 28th, 1914**, endorsed "Tender for the construction of four piers and two abutments of plain concrete, being substructure of Billings Bridge."

Any tender deceived after the above stated time will be declared informal.

Plans, specifications and full particulars may be obtained at the office of the City Engineer, on a deposit of $5, same being returnable when plans are returned in good condition to the City Engineer's Department.

Alternative designs, accompanied by working drawings may be submitted. Tenders must, however, be submitted on the design made by the City Engineer's department.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,
City Engineer.
Ottawa, July 8th, 1914. 28-29

Sealed tenders addressed to the undersigned, and endorsed "Tender for Breakwater, Negropoint, St. John County, N.B.," will be recieved at this office until 4 p.m. on **Wednesday, August 26, 1914**, for the construction of an Exteneion to the Breakwater at Negropoint, St. John County, N.B.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, St. John, N.B.; Halifax, N.S.; Post Office, Quebec, P.Q.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at St. John, N.B.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $50, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 30, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63273. 27-28

Tender for Coal and Ash Handling Apparatus

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, August 18th, 1914**, for the installation of coal and ash handling apparatus at the main pumping station.

Specification and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendiring as prescribed by City By-law must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, June 30th, 1914. 27-28

Sealed tenders addressed to the undersigned, and endorsed "Tender for Submarine Cables," will be received at this office until 4 p.m., on **Monday, July 27th, 1914**, for 23 knots of single conductor submarine telegraph cable (107 lbs. copper and 150 lbs. gutta-percha per knot) with sheathing of 12 No. 8 s.w.g. Iron Wires, to be delivered at Halifax, N.S., within eight weeks after order if one is given. Also for 14 knots same as above on several reels for distribution to be delivered at Vancouver, B.C., earliest dates of delivery desirable.

Specification and forms of tender can be obtained on application to the office of the General Superintendent of the Government Telegraph Service at the Department of Public Works, Ottawa.

Each tender for one or both of the above mentioned lots of cable must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 30, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63725. 27-28

New Methodist Church

Tenders will be received up to and including **July 25th, 1914**, for general or separate trades, required in the erection of a new building for the Morrison Street Methodist Church, Niagara Falls, Ontario.

Plans and specifications can be obtained from M. Henderson, Secretary of the Building Committee, 56 Morrison Street, Niagara Falls, Ont., or can be seen at the office of the undersigned.

Tenders shall be sent to the undersigned sealed and plainly marked on outside "Tenders for Methodist Church, Niagara Falls, Ont."

The lowest or any tender not necessarily accepted.

BOND & SMITH, Architects,
15 Wilton Avenue,
28 Toronto, Ont.

TOWN OF HANOVER

Province of Ontario

Waterworks Extensions

Sealed tenders for waterworks extensions addressed to the Town Clerk will be received up to 2 p.m., **Tuesday, July 21st, 1914**, for:

A.—Supply and erection of 100,000 gallon Steel Water Tower.
B.—Cast iron piping and valves.
C.—Laying piping, valves and fittings.

Copies of specifications of requirements can be obtained from the Town Clerk.

C.H.WITTHUN, Mayor.
JOHN MILLS, Clerk. 27-28

Sealed tenders addressed to the undersigned and endorsed "Tender for Telegraph Wire," will be received at this office until 4 p.m. on **Monday, the 27th of July, 1914**, for 270,000 lbs. of Galvanized Iron telegraph wire delivered at Montreal, Que., also 342,000 lbs. of same delivered at Vancouver, B.C., early dates of delivery desirable.

Specification and forms of tender can be obtained on application to the office of the General Superintendent of the Government Telegraph Service at the Department of Public Works, Ottawa.

Each tender for one or both of the above mentioned lots of wire must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, June 30, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63727. 27-28

Notice to Contractors

Sealed tenders marked "Tenders for Government House," addressed to the undersigned, will be received at this Department up to noon of Thursday, July 23rd, for the interior finishing of the main building of the Government House, Rosedale, Toronto, as per revised plans and specifications, including carpenter and joiner work, plastering, painting and glazing, marble work and steel work.

Plans and specifications can be seen at this Department. An accepted bank cheque payable to the Honourable J. O. Reaume, Minister of Public Works, for five per cent. of the amount of the tender and the bona fide signatures and addresses of two sureties or the name of a guarantee company approved by this Department, willing to provide bond for the due fulfillment of the contract, must accompany each tender. The Department is not bound to accept the lowest or any tender.

By order,

H. F. McNAUGHTEN,
Secretary Public Works Department.

Department of Public Works, Ontario,
Toronto, July 11th, 1914.

Newspapers publishing this advertisement without authority will not be paid for it.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Steel Gates for Regulating Dam, French River, Ont.," will be received at this office until 4 p.m. on **Monday, August 10, 1914**, for the construction of Steel Gates, Towers and Operating machinery for the Regulating Dam, Big Chaudiere Falls, French River, Ont.

Plans and form of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, and Shaughnessy Building, Montreal.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE:—Blue Prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, July 10, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—59123—29-30.

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, August 4th, 1914**, for the construction of the following sewers, viz.:

Garrison Creek Storm Overflow Sewer, Section No. 4, from 120 ft. south Harrison Street on Roxton Road to south limit Bickford Park, via Roxton Road, Lots 8, 9, 10, 13, 14 and 15, Plan 302, Shaw Street, Sully Cres., Montrose Ave., College Street and Beatrice Street.

West Toronto Sewer System, Div. No. 2, Storm Outlet, Section No. 2, through High Park.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tenders obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer, not members of the City Council or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, July 3rd, 1914. 28

Sealed tenders addressed to the undersigned, and endorsed "Tender for Section 2 of the Jetty at Steveston, B.C.," will be received at this office until 4 p.m. on **Tuesday, August 11, 1914**, for the construction of Section 2 of the Jetty at Steveston, at Mouth of the Fraser River, B.C.

Plans and form of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, at New Westminster, B.C.; Victoria, B. C., and on application to the Postmaster at Steveston, B.C.

Persons tendering are notified that tenders will not be considered unless made on the printed form supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE:—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $50.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, July 6, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—56586. 28-29

Cathedral Tenders

Tenders are invited for a Roman Catholic Cathedral to be built in Edmonton South, Alta.

Plans and specifications can be obtained from the office of Roland W. Lines, Architect, Edmonton, on the deposit of $50, which will be returned to bona fide tenderers if the plans are returned in good order.

Tenders to be sent in not later than noon, 30th day of July, accompanied with a marked cheque for 5 per cent. of amount of tender. 27-28

Tenders for School

Sealed tenders, marked "Tenders for Union School Building," will be received by the Secretary up to and including **July 18**, in whole and part, for the several trades required in the erection and completion of a ten room brick school building at Brighton, Ontario. Plans and specifications can be seen at the architect's office, Toronto, and at the Ontario Agricultural offices, Brighton. No tender necessarily accepted.

E. C. BROWNE, Sec.-Treasurer,
Brighton, Ont.

ELLIS & CONNERY, Architects,
Manning Chambers,
28 Toronto, Ont.

Notice to Contractors

Sealed tenders will be received by the undersigned up to 5 p.m. on July 24th for the erection of an eight-roomed school according to plans and specifications as prepared by Jno. Wilson, Architect.

Separate tenders on plumbing, heating and ventilating system (direct or Direct-indirect).

Marked cheque for five per cent. of tender to accompany same.

Plans and specifications may be seen at office of undersigned, The Contract Record office, Toronto, or the architect's office in Collingwood.

Lowest or any tender not necessarily accepted.

C. D. TRUEMAN,
Secretary Public School Board,
28 Midland, Ont.

Machinery and Materials

Sealed tenders, registered and endorsed on the envelope, tender for (tender bidden on) and addressed to H. H. Elliott, M.D., Secretary-Treasurer of the Town of The Pas, will be received up to 6 p.m., **August 11, 1914**, for the supply and delivery of the following machinery and materials.

Tender "A"—For the supply and delivery of two Sewage Lift Pumps.

Tender "B"—For the supply and delivery of House Meters.

Tender "C"—For the construction of Sewage Lift Chamber and Oil Tank Chamber.

A marked cheque for five per cent. (5 p.c.) of the amount of the tender must accompany each bid. The lowest or any tender not necessarily accepted.

Plans and specifications may be seen at the offices of the Consulting Engineers, Saskatoon, Sask.; the Resident Engineer, The Pas, Man.; Contract Record, Toronto, Winnipeg and Montreal, or a complete set of plans and specifications will be given or forwarded on deposit of $25 and a set covering all contracts on a deposit of $50, which deposit will be returned on receipt of a bonified tender and return of specifications. Specifications on House Meters to be obtained from the Saskatoon Office, only, without charge.

H. H. ELLIOTT, Secretary-Treasurer,
The Pas, Man.

MURPHY & UNDERWOOD,
Consulting Engineers,
28-29-30-31 Saskatoon, Sask.

Township of North Easthope

Tenders Wanted

Sealed tenders marked "Tender for Satchell Drain," will be received by the undersigned up to 2 p.m., on **Thursday, July 23rd, 1914.** The Council will proceed to consider the tenders immediately after the above hour at the Clerk's office, Amulree.

Plan, profile and specifications can be seen at the clerk's office or at the office of Jno. Roger, O.L.S., Michell.

The drain commences on Lot 27, Con. 11, and has its outlet on Lot 20, Con. 11 and is 5 miles long.

A deposit of $200 is required, cash or marked cheque.

The lowest or any tender not necessarily accepted.

J. D. FISHER,
Twp. Clerk North Easthope,
R. R. No. 1 Stratford.
Dated the 7th day of July, 1914. 28

Tenders for Motor-driven Fire Apparatus, Fire Hose and Rubber Covered Tarpaulins

Tenders addressed to the undersigned will be received by registered post only up to noon on **Tuesday, August 11th, 1914,** for the supplying of the above named articles.

Specifications and forms of tender, together with the conditions governing tenders, as prescribed by city by-law, may be obtained upon application at the office of the Fire Department, No. 152 Adelaide Street West, Toronto.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
City Hall, Toronto, July 8th, 1914. 28

Materials for Water Extensions

Tenders will be received up to 1 p.m., **August 1st, 1914,** for the supply and delivery of materials under sections "A"-"B" and up to 1 p.m., **August 15th, 1914,** for the supply and delivery of materials under sections "C"-"D" for water extensions in the City of Prince Albert.

"A" Approximately 8,000 lin. ft. 8-in. cast iron water pipe; 12,000 lin. ft. cast iron water pipe; 19,000 lbs. special castings.

"A1" Approximately 8,000 lin. ft. 8-in. steel water pipe; 12,000 lin. ft. 6-in. steel water pipe; 19,000 lbs. special castings for steel pipe.

"B" 30 8-in. Gate Valves.
75 6-in. Gate Valves.
30 Hydrants.

"C" Two 2,500 gallon per minute pumps with motors and piping.

"D" One 14-in. Venturi Meter.

Tenders will be addressed to J. B. Brown, City Clerk, Prince Albert, Sask., Canada.

Specifications and full information may be obtained from the City Engineer and at Contract Record, Toronto.

The City reserves the right to reject any or all tenders.

ANGUS SMITH, City Engineer.

J. B. BROWN, City Clerk.

Prince Albert, Sask.,
July 9th, 1914. 28

Tenders for Construction of Sidewalks

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, July 20, 1914,** for the construction of concrete sidewalks on Barry Ave., Appleton Ave., in Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street E., Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, July 10, 1914. 28

Tenders for Bridge Construction

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to six o'clock p.m. of **Wednesday, July 22nd, 1914,** for the construction of a reinforced concrete truss bridge over the Holland River, being the first bridge on this stream south of Newmarket, lots 90 and 91, Con. 1 in the Township of Whitchurch, County of York.

Plans and specifications may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Bridge Engineer.
Toronto, July 8, 1914. 28

Sealed tenders addressed to the undersigned and endorsed "Tender for Repairs to Eastern Pier at Newcastle, Ont.," will be received at this office until 4 p.m. on **Monday, August 10, 1914,** for the construction of Repairs to Eastern Pier at Newcastle, Durham County, Ontario.

Plans and forms of contract can be seen and specification and forms of tender obtained at this Department and at the office of the District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Pastmasters at Kingston, Ont., and Newcastle, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not ecccpted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE:—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20, made payable to the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 10, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—64231. 28-29

Tenders Wanted

Tenders will be received up to July 21st for the constructing of 4,100 feet of cement walk—contractors to supply all materials. Specifications may be seen at the office of the Clerk. A marked cheque for $200 must accompany each tender. The lowest or any tender not necessarily accepted.

S. H. SMITH, Clerk.
Streetsville, July 7th. 28

Notice to Contractors

Billings Bridge

Sealed tenders addressed to the Secretary of the Board of Control, Ottawa, Ont., endorsed "Tender for Steelwork, Billings Bridge," will be received up to 4 o'clock p.m. of the **28th July** next.

Any tender received after the above stated time will be declared informal.

Plans, specifications, form of tender and other information may be obtained at the City Engineer's office.

A deposit of $5.00 will be required for the safe return of plans.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE, City Engineer.
Ottawa, July 13th, 1914. 28

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Monday Noon, July 27, 1914

for enlargement of

Huron Street School
Withrow Avenue School

also for

Iron Stairs—Dewson Street School
Cabinet Work—Sundry Schools
Plumbing Work—Sundry Schools

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, not later than 12 o'clock noon on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted. All tenders must be on revised forms.

W. C. WILKINSON,
Secretary-Treasurer.
W. W. HODGSON,
Acting Chairman of Committee.
28

Position Wanted

Wanted by graduate Civil Engineer (1906), age 31, position as erection superintendent on steel erection, eight years' experience.

Open for engagement at once.

Box 50, Contract Record, Toronto. 27-28

Situation Wanted

ARCHITECT.—Excellent recommendations as designer, draughtsman, and perspective artist. Reinforced concrete and steel specialist. Address 6 Kinkora Avenue, off MacKay, Montreal.
28-29

Eden Smith & Son,
Architects

Toronto Housing Co., Spruce St.

Hill & Strathy,
Contractors

1,250,000 Sun-Tex Brick were used for eight of these buildings.

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are absolutely uniform in size, color and texture and possess unequalled wearing powers.

Architects and Contractors who wish to obtain the best results should specify Sun-Tex Clay Products.

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Architects

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2,000,000 Sun-Tex Brick were used in the construction of the dwellings illustrated.

Let us furnish you with quotations.

The One Price Company

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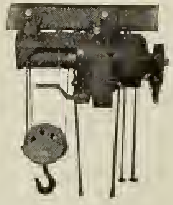

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Established 1855 TORONTO
Branches: Vancouver and Winnipeg
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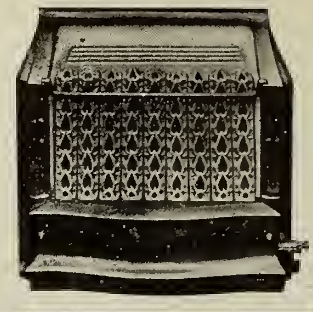

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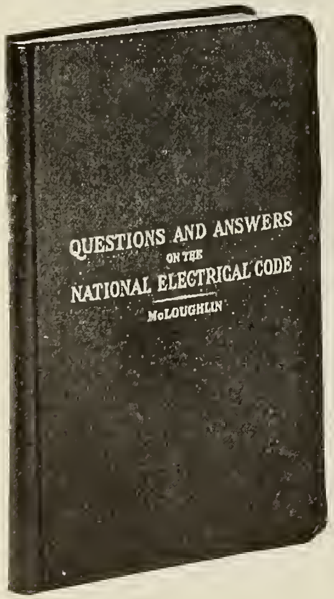
of the Residence
Heating Question

For years "Gas Fires" have been regarded as experiments. **Later Experiments** in Chemical Laboratories by Scientists, however, have brought "Gas Fires" out of this stage and placed them on the market as practical gas appliances, also as a perfect means of domestic heating. The design of the burners has received special attention, until now it is possible to obtain "Gas Fires" that give perfect combustion. The new grates are very attractive in appearance. The illustration shown herewith being an example of one of the new designs. **55 per cent. of the total B.T.U.'s in the gas is given out as Radiant Heat.** 25 per cent. of the remaining B.T.U.'s is given off as convected heat. The balance is used in creating a draught in the flue, removing the products of combustion, and thus also assisting in proper ventilation of the apartment. Full information on request.

The Consumers' Gas Co.
12-14 Adelaide St. W. TORONTO



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on the
National Electrical Code

It tells at once the answer to the questions on code requirements.
Contractors, electricians and wiremen write us that it hits the mark for them. It saves them time, trouble and real money.
Every question is carefully indexed so that you can locate the fact you are after instantly.
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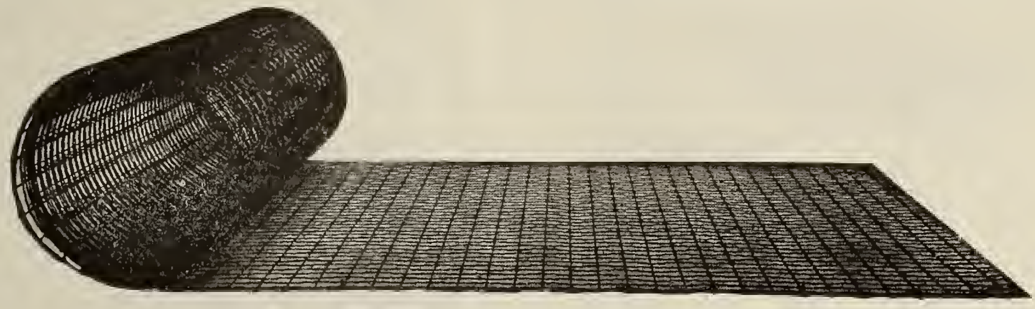

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Continuous lengths. Any width convenient to handle. Mesh and size of wire to suit requirements. Convenient to handle and cheaply applied. Cheapest and best for floors and roofs.

WIRE ROPE *Write for Catalogue No. 5* *WIRE LATH*

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We supply ROOFING, WATERPROOFING and INSULATING MATERIALS, and undertake contracts for Roofing, Waterproofing, Tar Rock, and Mastic Asphalt Flooring. Our Complete Equipment enables us to execute the work in accordance with Architect's and Engineer's Specifications.

Our work on many notable Canadian Buildings is a guarantee of our ability to successfully carry out the most important contracts.

Electric Steel Castings

Our Welland plant will be ready to furnish ***Carbon, Manganese, Alloy Steel Castings*** and ***Forging Ingots,*** by the end of May, made by the Electric Furnace process.

This process makes a dependable high grade steel and steel casting, a tough homogeneous material, free from blow-holes, and having a remarkable resistance to fatigue.

Write us for prices and particulars

The Electric Steel & Metals Co., Ltd.
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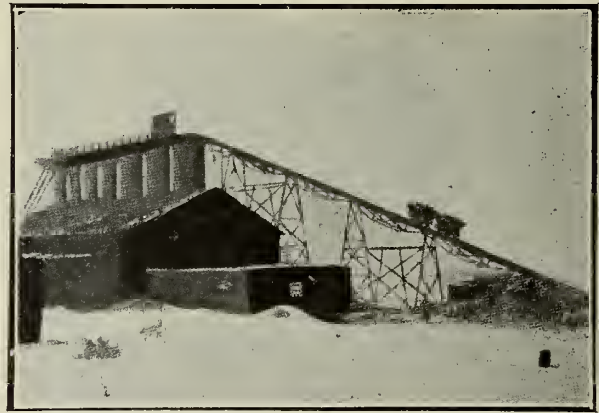
All Steel Wheelbarrow

The "Erie" line of wheelbarrows includes every type required by the contractor. Made with trays of welded steel 18, 16 or 14 gauge to hold 3, 4 or 5 cubic feet of material.

The barrow illustrated has forward dump and wheel guard. The handle is strong and well braced. The legs are of channel steel.

Write us for prices, etc.

The Erie Iron Works, Limited
St. Thomas, Ontario



Standard White Lime Co.
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Stair at Provincial Museum, Toronto.

This is a good example of Meadows' stair work. Our plant is complete for the successful manufacture of this particular class of work. Specifications can be followed or we will submit designs.

Careful attention to details and thorough workmanship have made Meadows' stair work popular.

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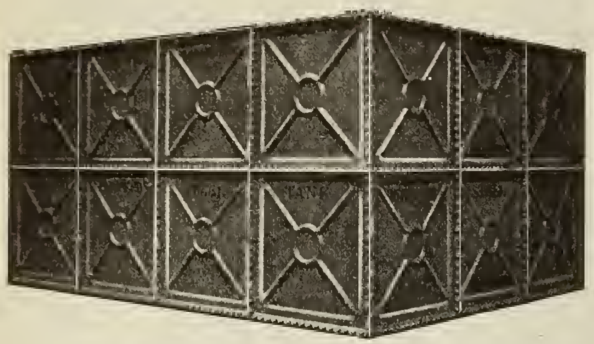

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Patent Pressed Steel Tanks

are built up of plates 4 ft. square by 5/16th in. thick. There are only three types of plates and all are interchangeable. Easily erected by unskilled labor.

LIGHT STRONG CHEAP UNBREAKABLE.

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STEEL PIPES—Welded or Rivetted

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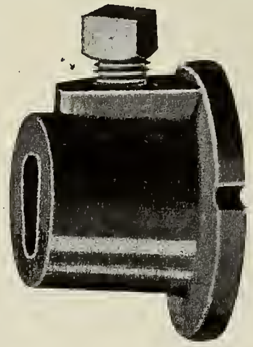

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Secured to the ends of round rods passed through your forms, these inexpensive clamps hold the centering rigid, resisting a strain exceeding the tensile strength of the steel rods themselves.

Clamps are easily applied, adjusted and tightened. A wrench releases them. Pull the rods out of the concrete with our Rod Puller.

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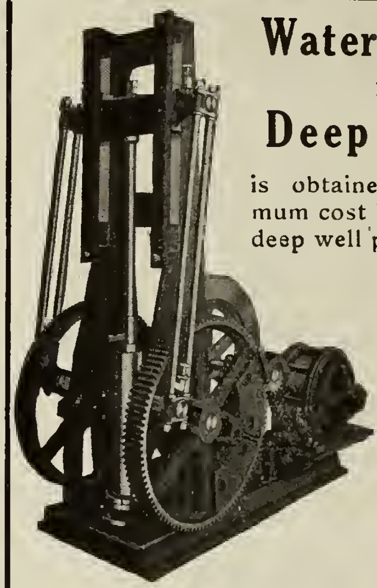
Agents for Ontario and Eastern Canada



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is obtained at a minimum cost by use of our deep well pumps.

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Manufacturer of a Complete line of **DEEP WELL SUPPLIES** including Steam, Belt and Motor Driven **DEEP WELL PUMPS**, Wind-mill and Hand Pumps, Working Barrels and Valves, Pump Rods and Pump Rod Joints, Drill Rods and Drill Rod Joints, Drilling and Well Tools.

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are strictly high grade. Are built to meet all requirements of the building trade.
The price is exceedingly low considering the quality.

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TORONTO (112 York St.) F. D. Emsley, Mgr.

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Adelaide St. W., Toronto

This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

Centrally situated
Light on four sides
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Vaults
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One block from four car lines
Floor area, 6,300 sq. feet, each floor.
Building ready for occupancy July 25th.

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Union Bank Building - Toronto

Sturtevant

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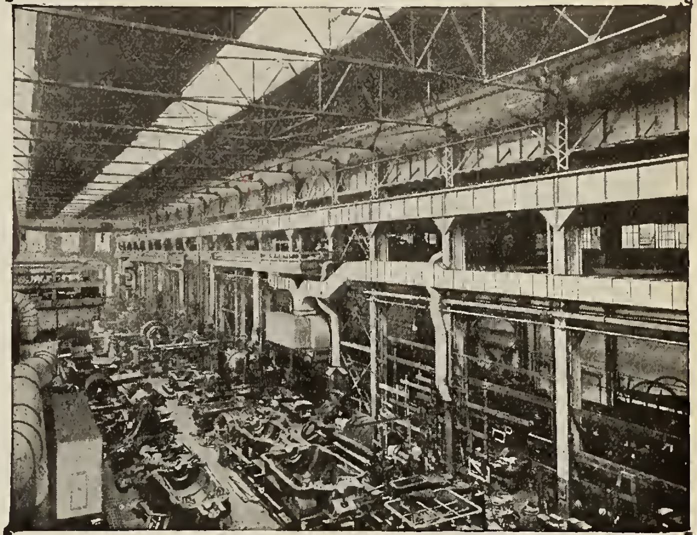
Heating System of the



New York Shipbuilding Co.

The above illustration shows the STURTEVANT Heating System installed in the Machine Shop of the New York Shipbuilding Company, one of the largest ship building companies in the United States.

Four sets of apparatus are used, two placed on each side of the shop. The fans are driven direct connected by STURTEVANT engines and each operates in connection with a STURTEVANT pipe coil heater.

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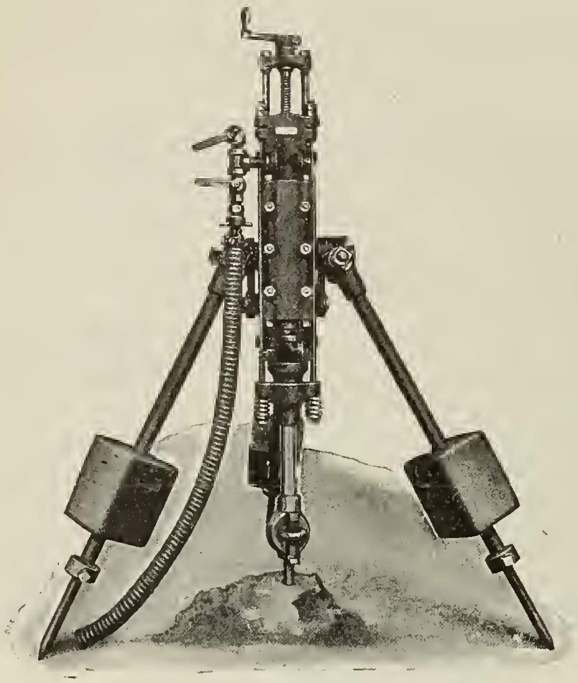

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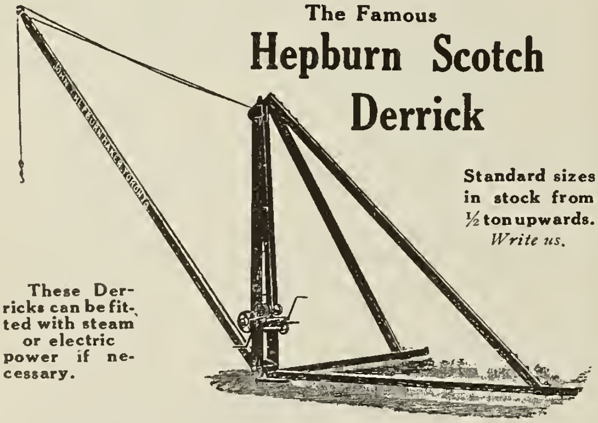

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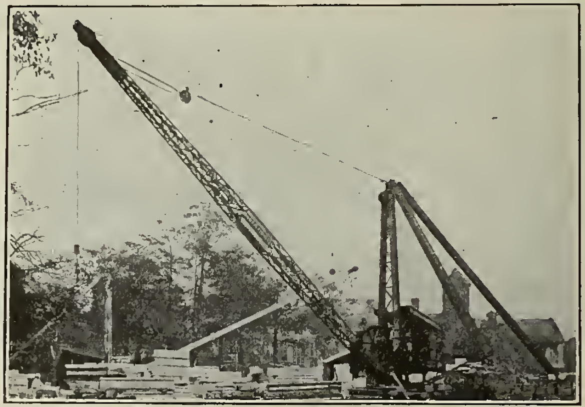

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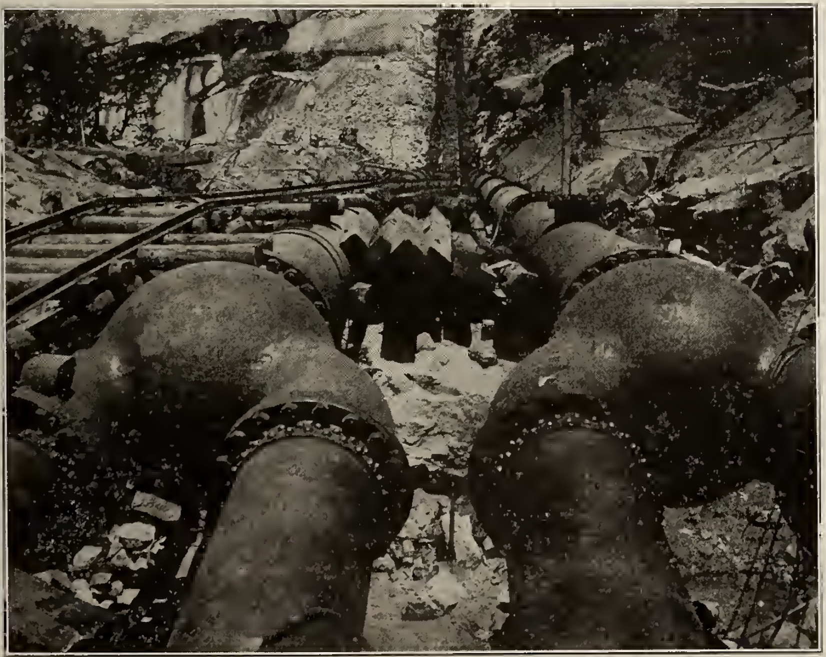

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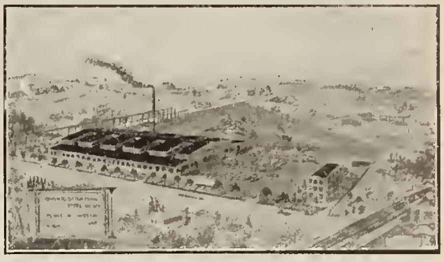

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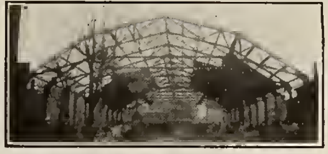

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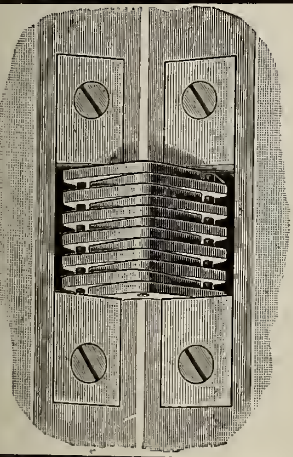

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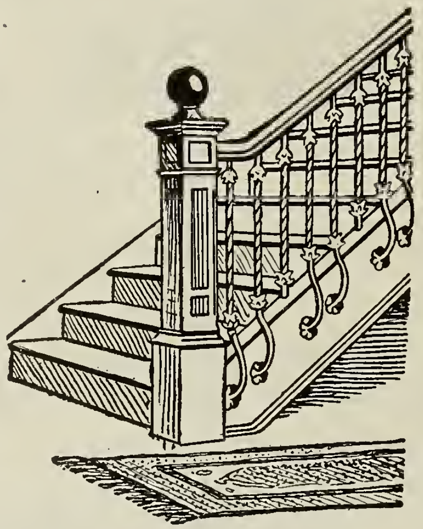

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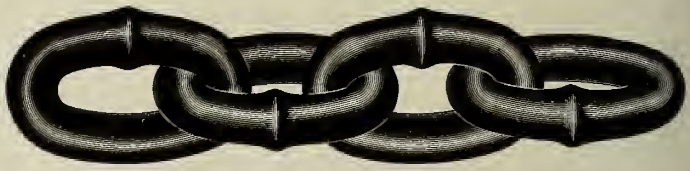

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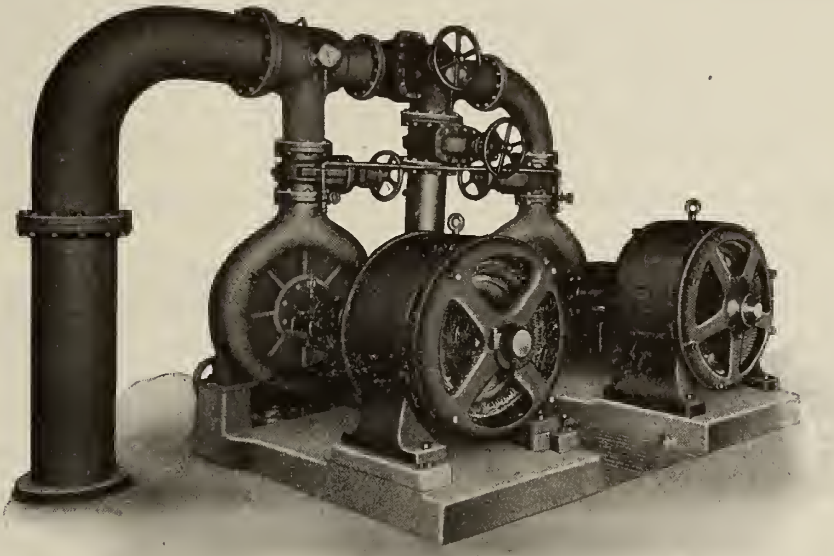

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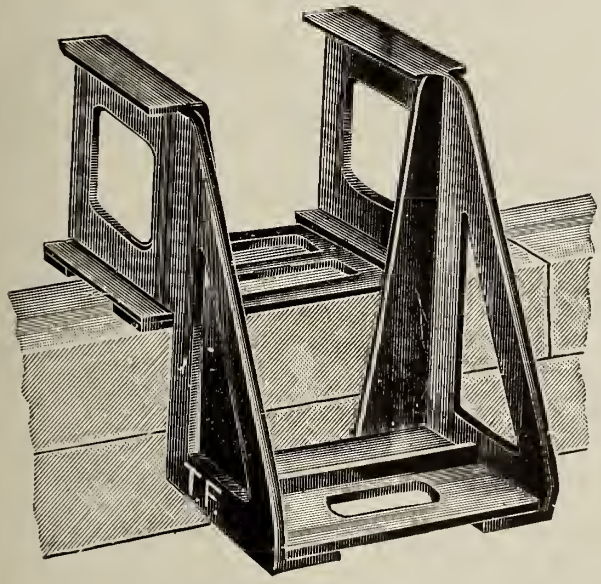

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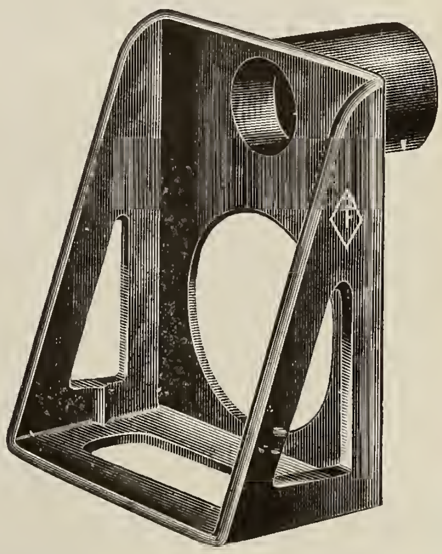

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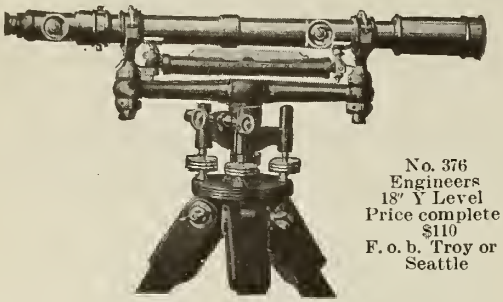

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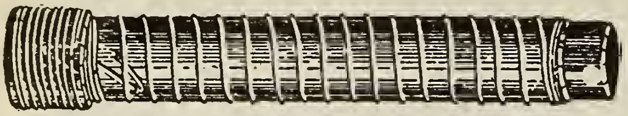

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Reservoir Tanks for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

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RAILS New and Relaying Switches, Turntables, Etc.

Carried in Stock

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Jno. J. Gartshore, Toronto

Do You Think

that you can Afford

to pass us by before getting our prices on your requirements or before putting in your tenders on

Plate Sheet Fancy

or any kind of

Glazing Glass

The

Consolidated Plate Glass Co.

of Canada, Limited

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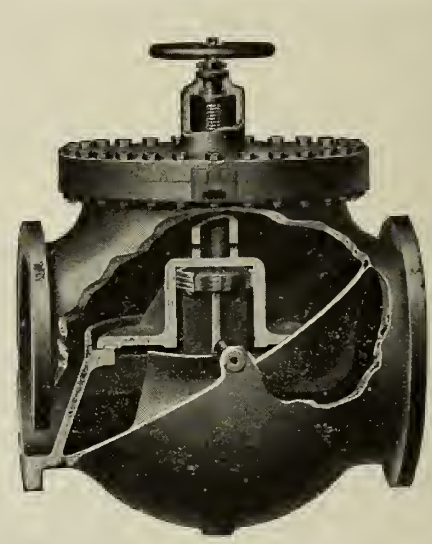

Horizontal Automatic Exhaust Relief Valve

We make automatic exhaust relief valves of all sizes and types—horizontal, vertical, angle and downward discharge. An inside dashpot of ample size eliminates shock in closing and a water seal insures the valve against leakage.

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PITTSBURGH VALVE,
FOUNDRY & CONSTRUCTION CO.
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ENGINEERS FOUNDERS MACHINISTS

ATWOOD

James Thomson, President. J. G. Allan, Vice-President. James A. Thomson, Secretary.

THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.

LIMITED

Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

HAMILTON, ONT.

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Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

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HOISTING ENGINES
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MOTOR CRABS
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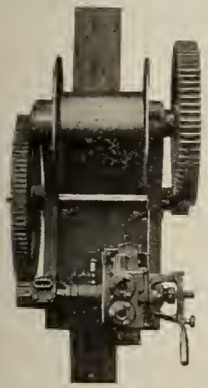

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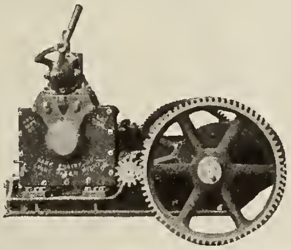

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"Queenston Blue" Limestone

in Sawn Slabs

as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

The Queenston Quarry Co., Ltd.
ST. DAVIDS, ONT.

Crushed and Rubble Stone

Our quarry has a capacity of 300 tons per day, and with excellent shipping facilities we can supply your requirements in all sizes of this stone on shortest notice.

HUMBER BRICK YARDS
Lime, Sewer Pipe and Fire Brick

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for Interior Construction

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Sole Manufacturers under Canadian and U. S. Letters Patent
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NATIONAL IRON WORKS, Limited

LARGEST MANUFACTURERS IN CANADA OF

every size for Water, Gas, Culvert or Sewer, **Carried in Stock**

Lake or Rail Shipments Offices, Works and Docks, TORONTO

THE HAMILTON BRIDGE WORKS COMPANY, LTD., Hamilton, Canada

ANNUAL CAPACITY 36,000 TONS, Shop "A" 18,000 Tons, Shop "B" 6,000 Tons, Shop "C" 12,000 Tons
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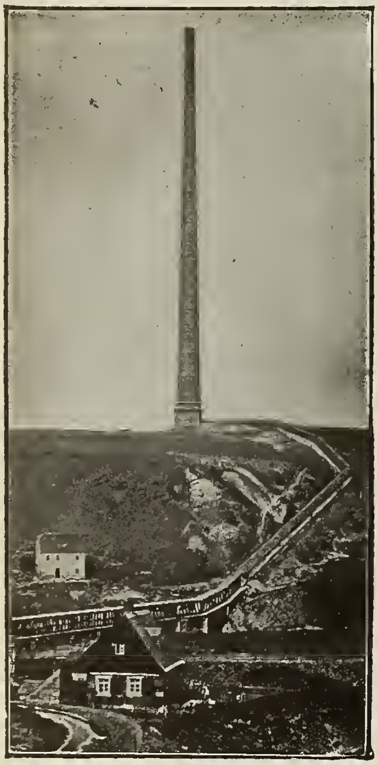

460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a **HEINICKE**.

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Representatives for Canada:
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BRICKS

We manufacture

RED PRESSED BRICK
RED WIRE-CUT BRICK
RED RUFFESTRY BRICK
FLASHED PRESSED BRICK
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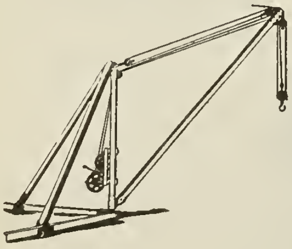
We guarantee prompt shipment and satisfactory delivery.

Our bricks are good and our prices right—write us for quotations.

Russell Shale Bricks, Ltd.
RUSSELL, ONT.

Sasgen Builders' Derrick



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They have been used on big construction work in part of the country with the utmost satisfaction.

We also manufacture Stone Grab-Hooks, Timber Tongs and Timber Dollies.

Sasgen Derrick Co. 1 Wabash Avenue
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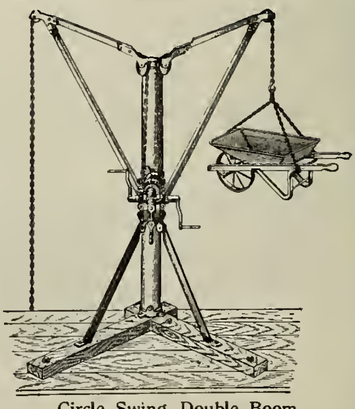

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Neptune Meter Co.

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TRIDENT Frost-Proof Water Meters

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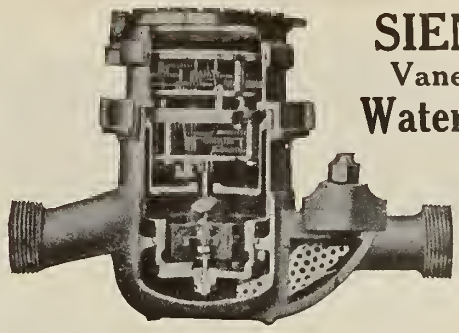

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Dry Running Type

The Main Advantages:

Simple, solid construction, involving only a few easily interchangeable parts. Best workmanship and accurate adjustment. Large sack-like strainer which has five to ten times the clear cross section of the connecting sockets. This can be taken out without removing meter from pipe. All toothed wheels are cut on special machines, not stamped. Only the best celluloid is used for vane wheels. Meters are fitted with regulating device easily adjusted from outside. Graphite is used for bearings of vane wheel shaft, rendering oiling of bearings unnecessary and is not influenced by water containing salts or acids. Frost proof device.

Siemens have been making water meters for the last fifty years.

Literature on request.

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Head Office: Transportation Building

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MEXICAN EAGLE ASPHALT

TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

Purchase MEXICAN EAGLE ASPHALT because:

1—It is more cementitious than other asphalts.
2—Water will not readily injure it.
3—Exposure to sun and air will not cause its deterioration.
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6—Shocks will not crack it. It is very malleable.
7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it
9—It has over 99 per cent. bitumen. Purest on the market—therefore free from deleterious matter.
10—It is so constituted that it will not be injured by the heat necessarily applied to melt it for paving operation.

Samples, prices, analyses, etc., on request

The Asphalt and Supply Co., Limited

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BELL AND SPIGOT STEEL PIPE

COATED AND WRAPPED

Made in sizes from 2″ to 10″ inside diameter with different thicknesses for varying pressures.

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STEEL TANKS

Three Rivers, Quebec
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50,000 gallons.	149 feet to top
120,000 "	100 feet to top

Hemispherical and Segmental Bottoms

Manufactured at Pittsburgh, Pa.

Erected Anywhere

We have special designs for Municipal, Railway and Industrial service.

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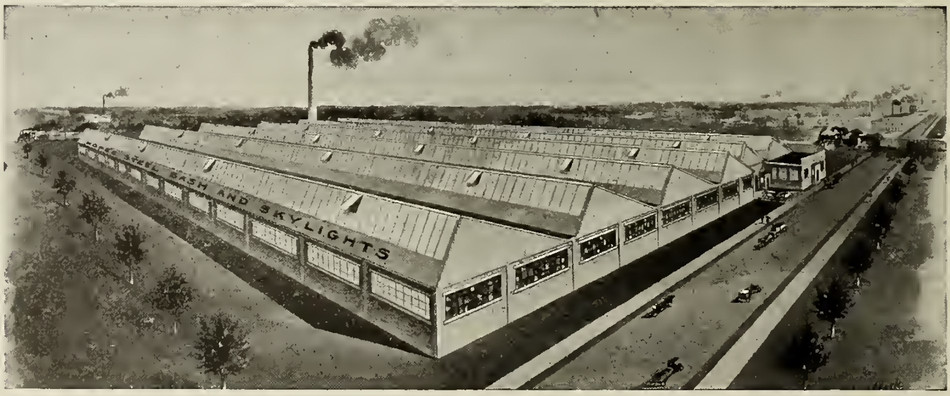

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HOPE STEEL SASH

Embodies points of merit that make it worthy of your consideration. Scientifically designed and economically constructed it recommends itself to discriminating architects and engineers.

HOPE SASH has demonstrated its superiority in thousands of buildings in Canada and the United States as well as other parts of the world. It is a sash with a reputation for excellence back of it.

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We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

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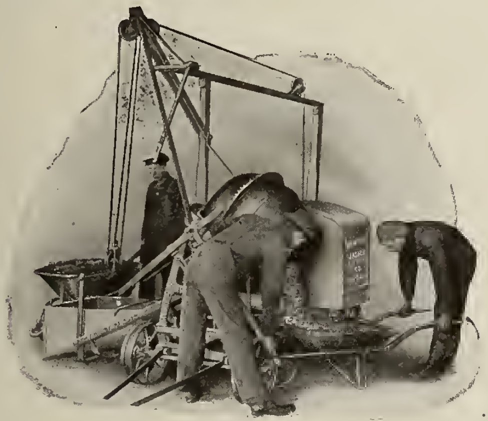
STOP! - LOOK! - LISTEN!
just the Mixer you've been wishing for
The "Big-an-Little"



1914 Model now ready

The small mixer has proved its worth. You know it pays better to have one or more small portable mixers than to mix by hand or to have a great big clumsy mixer. The question has been to get a Dependable Small mixer at a low price.

The "Big-an-Little" is the biggest and best small mixer on Earth, and our Low Prices amaze the Mixer World. They are used everywhere. Write us NOW.

The Jaeger Machine Co.
Columbus, Ohio

Water Purification

RANSOME
Drifting Sand Filters

THIS system has been accepted by the City of Toronto after a thorough test, and a plant having a daily capacity of 60 million imperial gallons is now under construction. The filters can be installed in either the gravity or pressure systems.

Designs and estimates furnished on application.

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Limited
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WIRE CLOTH AND WIRE GOODS

Concrete Bonding
Elevator
Overhead Guards

Enquiries solicited.

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Local Agents Wanted in
Quebec, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver

Water Filters
1,000 to 1,000,000 Gallons a Day

Refrigerating Machinery
1/4 to 60 Ton Daily Capacity

Water Purifiers
4 Gallons to 5,000 Gallons a Day

Refrigerators and Refrigerating Boxes for Ice or Machine Refrigeration
Hotel, Restaurant and Saloon Equipment and Supplies

EQUIPMENT & SUPPLIES, LIMITED
302 McGILL BLDG., MONTREAL, P. Q.

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11.50 to $12; wire-cut brick for foundation work, $9.50 to $10; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $32; sand-lime brick, $8.60, King Edward siding; $7.50 at the mill; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 66c per gal. of 9 lbs.

Raw linseed oil—in bbls., 63c per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 69c.

MONTREAL PRICES

CEMENT, LIME AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Enamel Concrete Brick—grey $24, red $24, buff $25, white $47, plain pressed $12 per thousand, all f.o.b. Montreal. Immediate delivery at any time.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15c basis per pound; British manilla, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 65c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 lbs.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3; $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

(Continued on page 106)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

Warehouse Stocks:
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WIRE NAILS and other **WIRE PRODUCTS**

The Simplex Drag

The simplest form of an efficient road drag, priced low enough to compete with plank drags and of far greater service. The best materials are used. By turning over upon the curved runners it is moved from place to place with ease. 7 feet long; weight 250 lbs.

Our 1914 Model has all Steel Top, blades are detachable, and new blades can be replaced at small cost. Drag is equipped with a strong chain and pear link.

"Panama Simplex" Road Drag

The "Township Winner" Lever Drag

This drag is the result of many years of practice in road machine building and is positively the most durable and efficient road drag on the market. All steel 7 or 8 feet long Blades are 6 inches wide.

The "Township Winner" Drag

This drag has a number of features not found in any other drag. It has interchangeable and reversible blades, flexible all-steel frame, adjustable hitch and steel top.

The low hinge joint on this drag makes it possible for the operator to adjust the blades while the machine is in motion.

When using any of our drags for heavy work that would cause machine to skid, we recommend the use of our Anti-Skidding Truck, which is attached with a long hitch to the rear of the machine, having a seat directly over the wheels, which makes the flange very effective. This truck can be adjusted to any angle and will positively prevent any drag from skidding away from the work.

This attachment, while not shown on the cut appearing herewith, is fully illustrated in our catalogue.

The Exeter Mfg. Company, Limited
Exeter - Ont.
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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from p. 104.)

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.40 per 100 lbs.; square twisted, $2.50 per 100 lbs.; channels, angles, beams and plates, $2.90 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $9.00 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.75; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25; all less 40 per cent.

SUNDRIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10 per 100 lbs.

Boiled linseed oil—in bbls., 85c per gal. of 9 lbs.

Raw linseed oil—in bbls, 83c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

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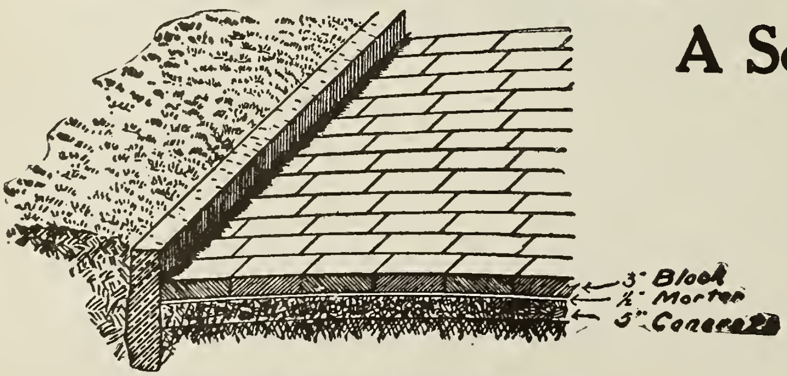

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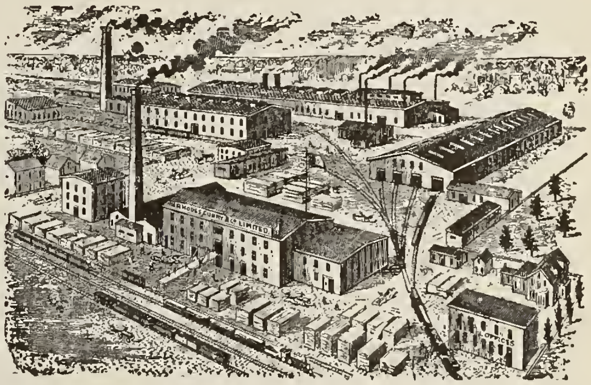

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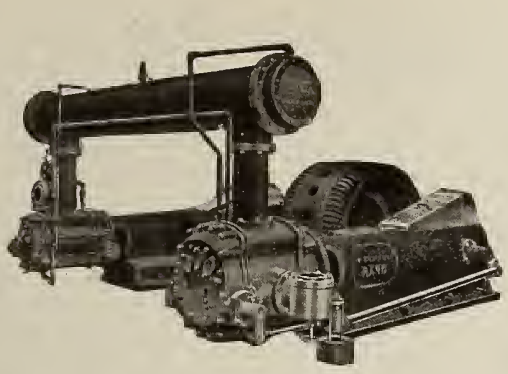

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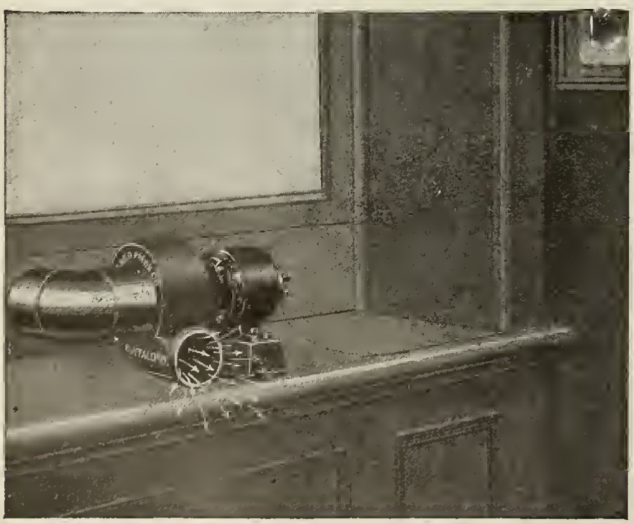

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Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price $2.00

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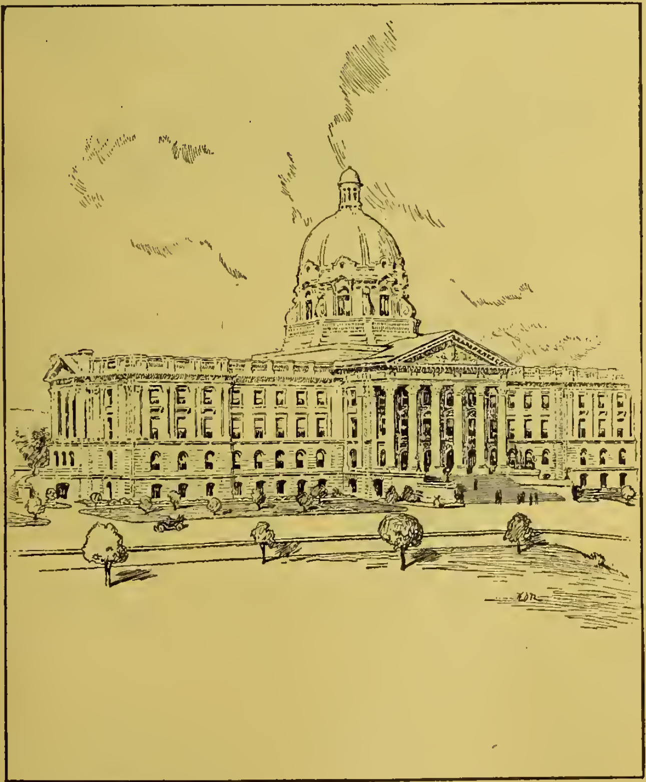

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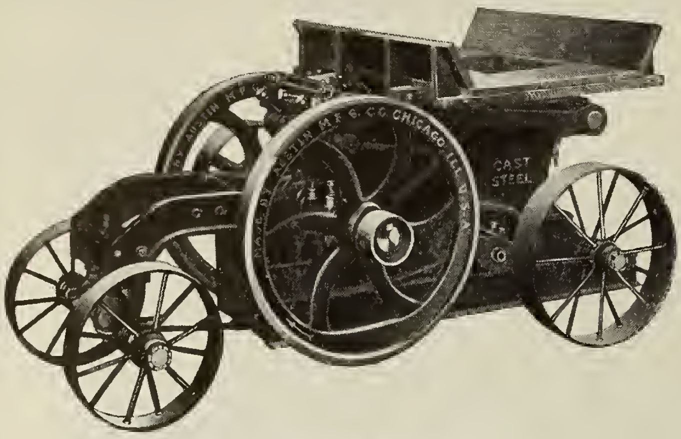

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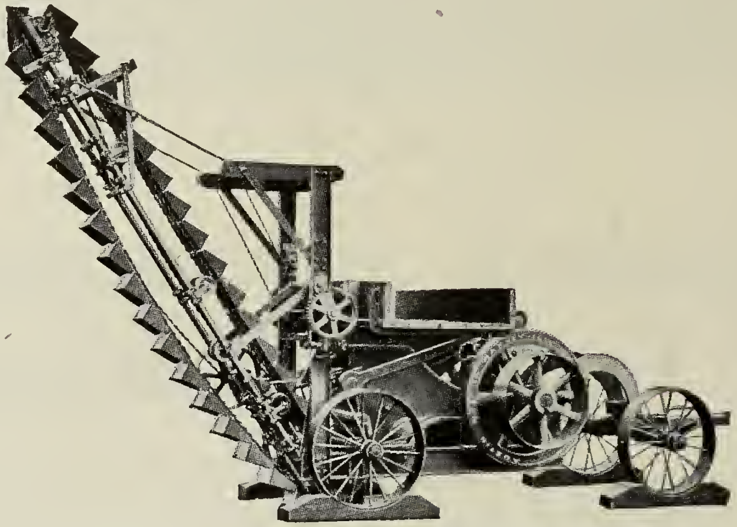

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150 to 300
tons of 2″
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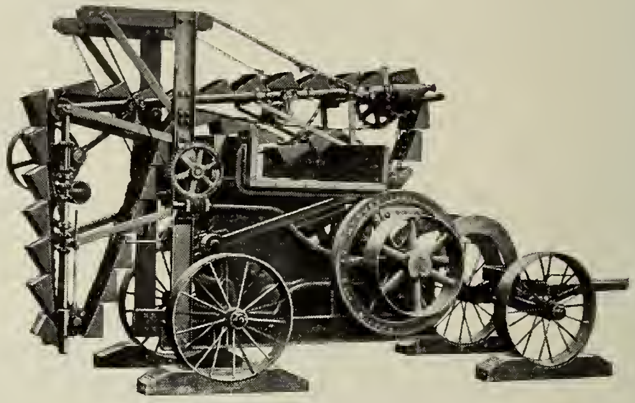

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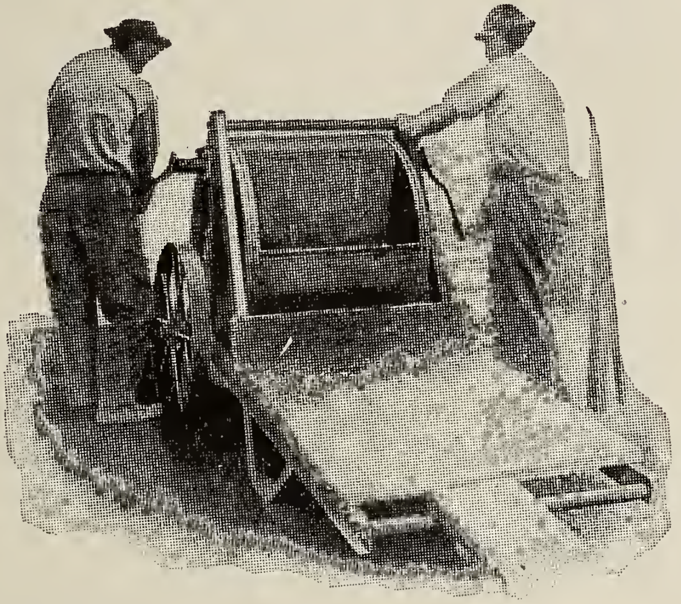

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WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave. and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

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- Hull Iron & Steel Foundries

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- Canadian Fairbanks-Morse Co.
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- Jenckes Machine Company

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- Barber Asphalt Paving Co.

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- Lecky & Collis

Drill Steel Sharpeners
- Canadian Ingersoll-Rand Co.

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Main Street, Wheeling, W. Va., Paved with Bessemer Block

Judge By Actual Results

PAVING BRICKS all look more or less alike. But their wearing qualities—that's a different matter. Then you can judge only by actual service. The busy street shown above is paved with

BESSEMER
Wire-Cut-Lug Paving Block

It has given eminently satisfactory service under hard, heavy usage for many years and it will continue to do so for many years to come.

The highest quality of shale, modern factory methods and skilled handling produce in Bessemer Block the ideal road-paving material. Dustless and mudless roads are made possible with Bessemer Paving Block. They are tough, strong, durable and uniform.

Complete information furnished upon request.

Bessemer Limestone Company

Manufacturers of Bessemer Repressed and Dunn Wire-Cut-Lug Paving Block.

Youngstown, Ohio

CANADIAN AGENTS
G. W. Essery, 47 Yonge Street, Arcade Building, Toronto
Stinson-Reeb Builders Supply Company, Montreal, Quebec

Head Office and Works

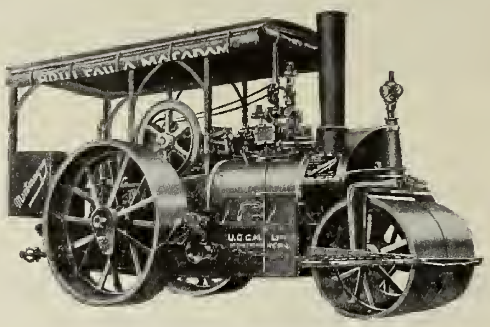
"Montmagny" Modern Road Builders

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The **"Montmagny"** line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



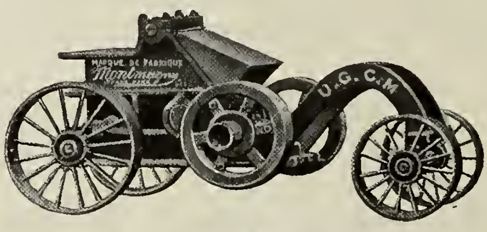
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double-Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"



"Montmagny" Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

"Montmagny" Portable Steel Bin.

Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

M-C Rail Track Mixer

Its reputation for lasting, economical service—"**most mixing with least fixing**"—is the biggest thing to remember about the

M-C RAIL TRACK MIXER

Here it is—mounted on trucks, with elevating side loader and automatic water measuring tank; operated by steam engine.

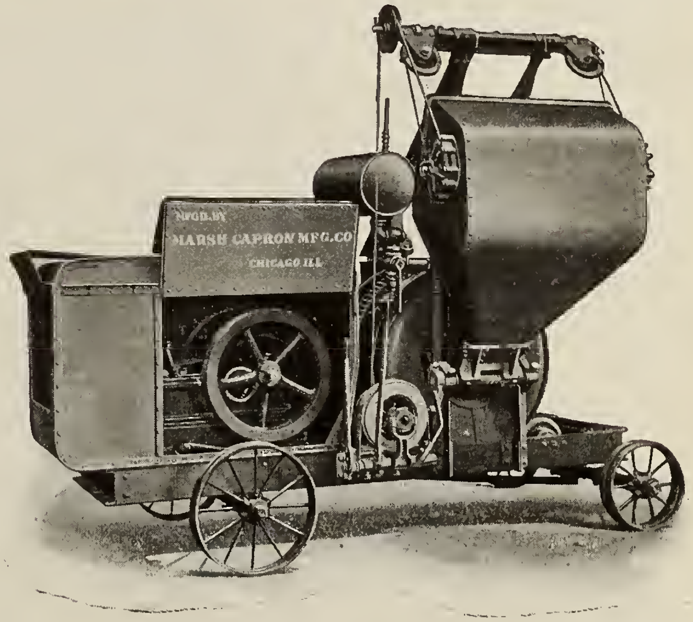
The all steel rail tracks around the drum, the segmental drum gear, the roller-bearing wheels of chilled semi-steel, the semi-steel drum of great strength and toughness, the heavy steel channel frame, the M-C friction clutch are some of the construction features of this machine which will end your mixer troubles.

The two illustrations show you M-C Rail Track Mixers operated by steam and gasoline power.

This mixer is built in five sizes, with capacities of 1/4, 1/3, 1/2, 3/4, and 1 cu. yard of concrete per batch.

Capacity 6 to 27 cu. ft. of mixed concrete, or 9 to 40 cu. ft. of loose material per batch.

We suggest that you find out more about the machine illustrated here before you buy any mixer.



CANADIAN FAIRBANKS-MORSE CO., Ltd.

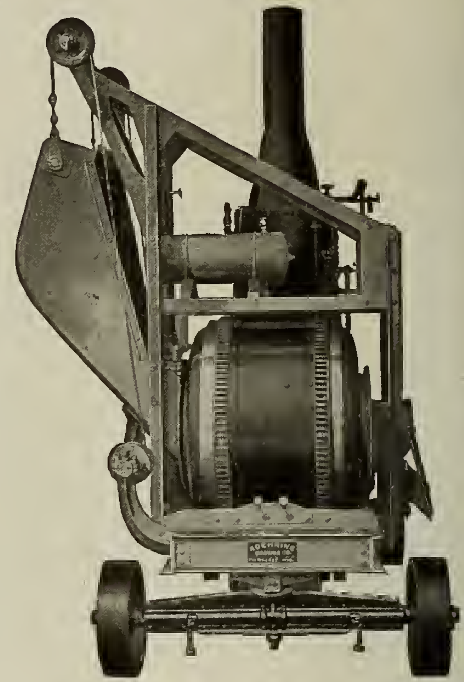
Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

Manufactured by

Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

NOTE THE PERPENDICULAR POSITION OF THE

Koehring Loader



See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

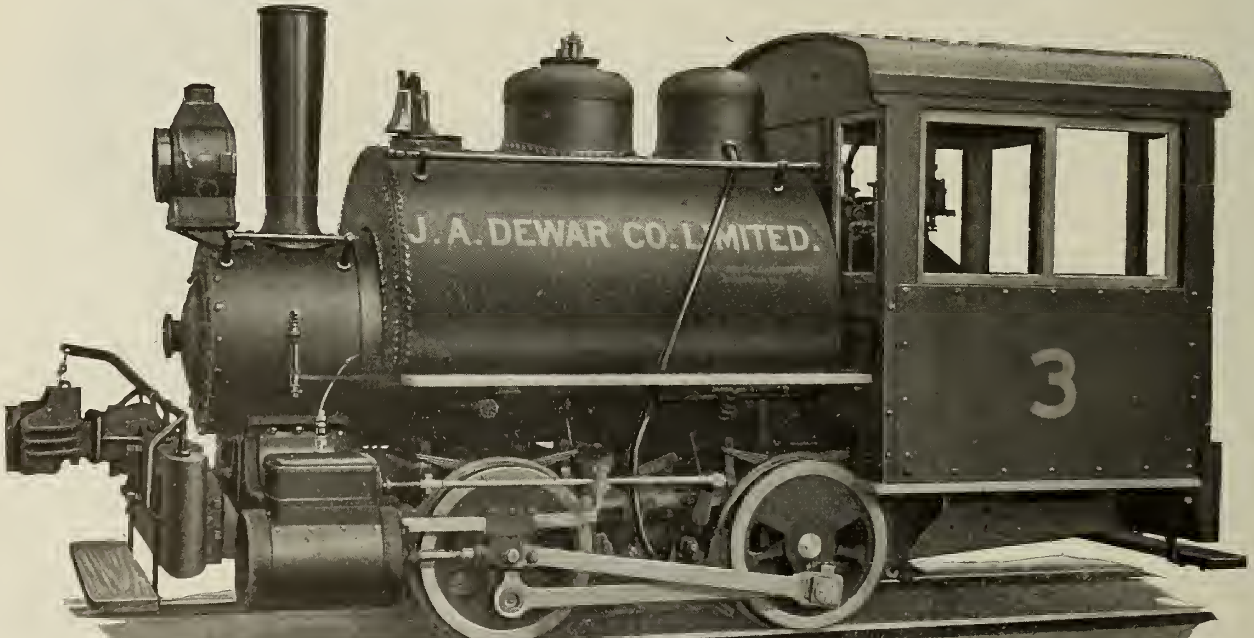
These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

Standard Hoisting Engine

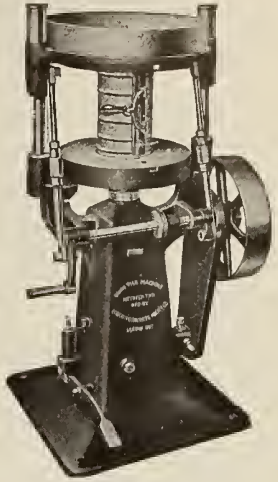
The London Concrete Machinery Co., Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES:
WINNIPEG—565 Portage Ave.—W. H. Rosevear, Manager.
CALGARY—622 9th Ave. West—P. D McLaren, Manager.
TORONTO—112 York Street—G. B. Oland, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

AGENCIES
Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Port Arthur and Fort William, Ont.—Northern Agency & Equipment Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

the Largest Manufacturers of Concrete Machinery in Canada



Dunn Cement Drain Tile Machine

Concrete Mixers

—

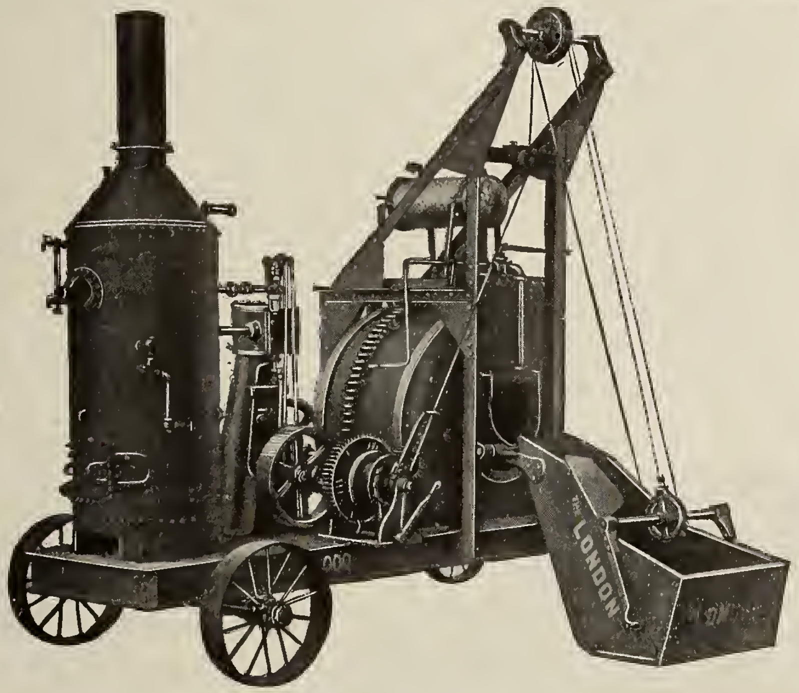
Mortar Mixers

—

Concrete Block Machines

—

Cement Brick Machines



London Standard Drum Batch Mixer

This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

—

Rock Crushers

—

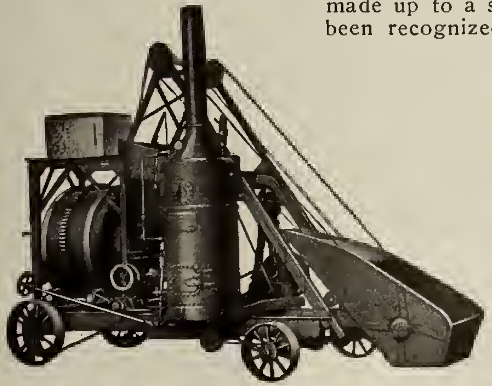
Pumping Outfits

—

Hoists and Derricks

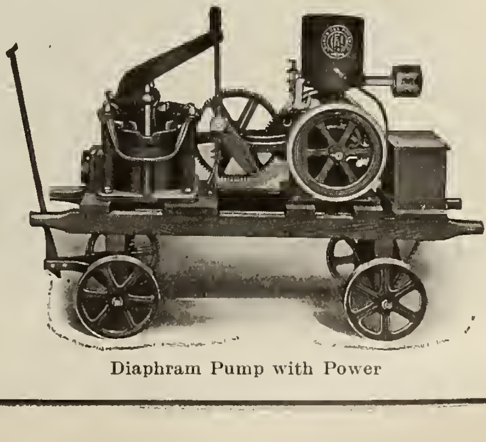
Our success as manufacturers of concrete machinery is due to a constant observance of the slogan "Quality first," and following this policy our machines have always been made up to a standard, not down to a price. This fact has been recognized by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.



Rear Discharge Paving Machine with Forward Loader.

Correspondence Solicited.



Diaphram Pump with Power

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  - Hope & Sons, Henry
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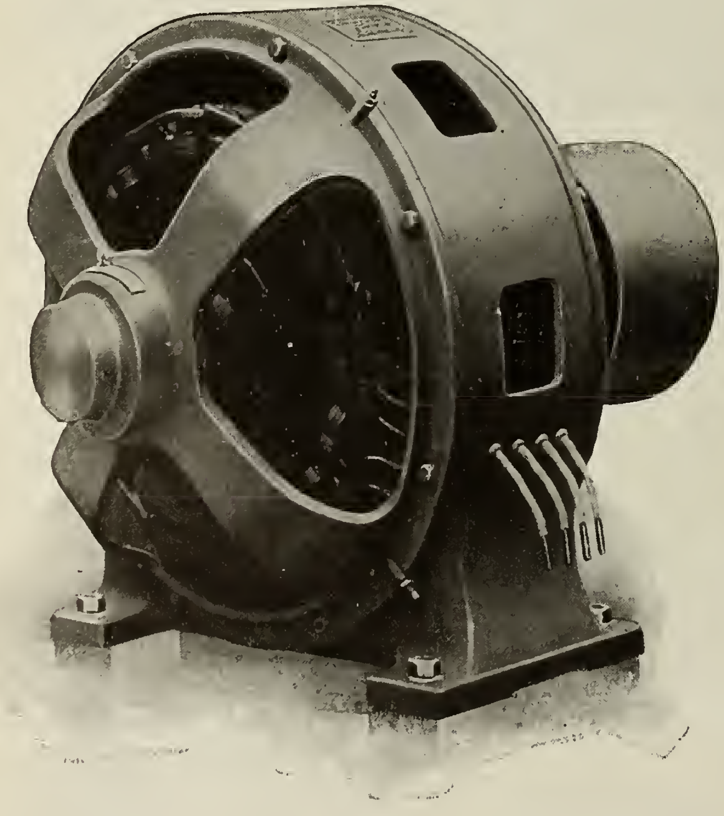


PEEBLES MOTORS

Ferranti Electrical Co. of Canada, Ltd.

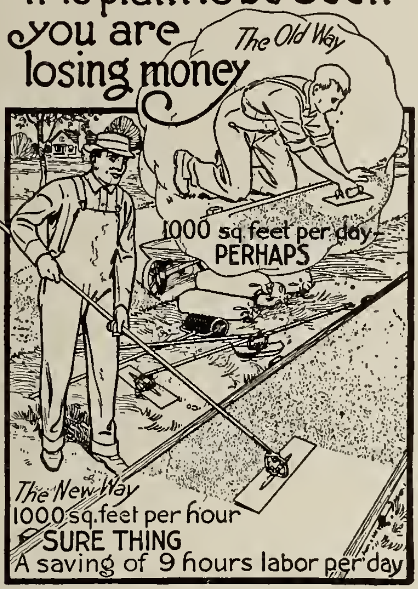
90 Sherbourne Street
TORONTO

Farmers Advocate Bldg.
WINNIPEG

If you are not using

"ABRAM" TOOLS

It is plain to be seen you are losing money



Abram Cement Tool Co.,
Windsor, Ontario

WESTERN

Spreader Cars

The Western Spreader Car has recently been improved and strengthened at various points. The flat car is specially designed to withstand the strain which a machine of this type must undergo in operation. The Western Spreader is equipped with a pair of blades which can be used simultaneously or separately. These blades will level the earth to a distance of 15 feet from the rail, and can be swung back rapidly against the car when passing trains.

Our illustrated catalogue contains full details of the best line of earth and stone handling machinery in America.

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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- Gartshore-Thomson Pipe Co.
- Kerr Engine Company

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- Morris Crane & Hoist Co., Herbert

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- Canadian Locomotive Company
- Montreal Locomotive Works
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- Mussens Limited

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(Continued on page 18)

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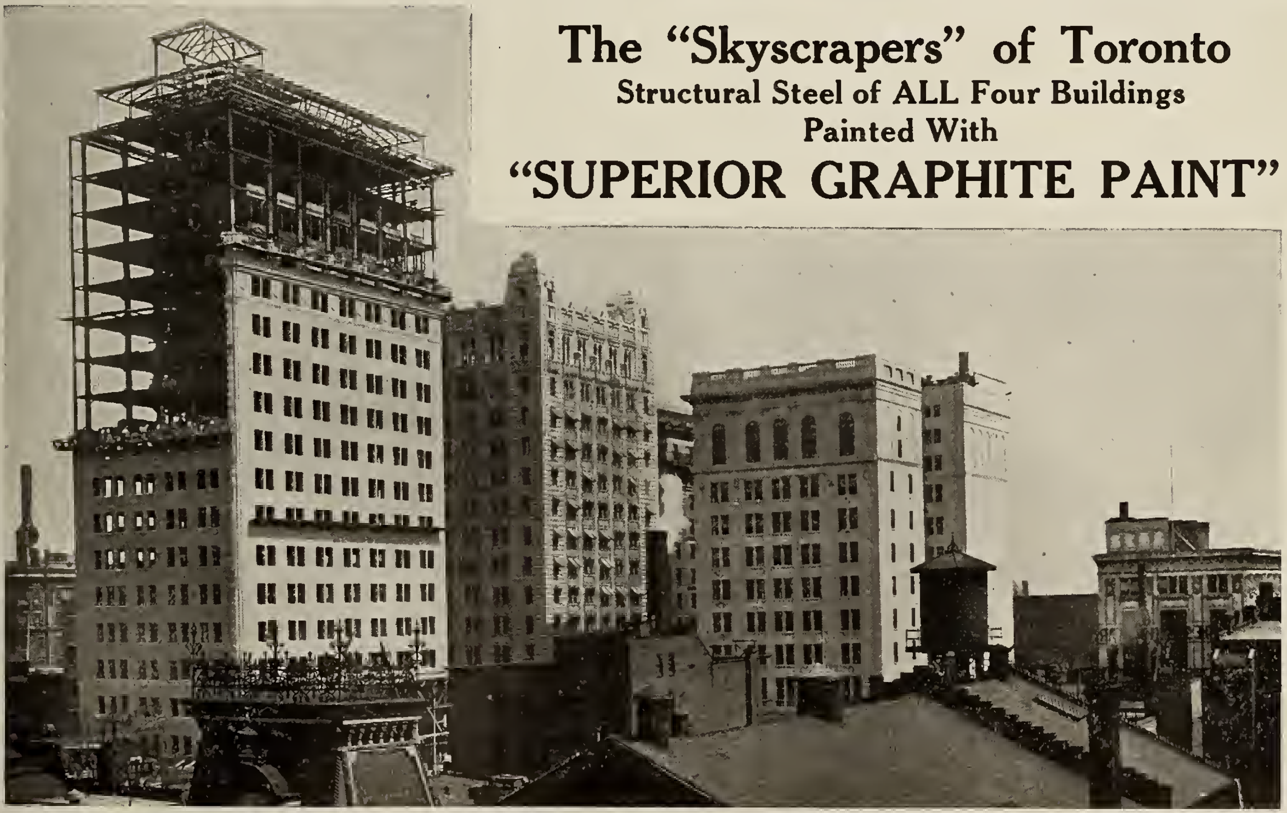

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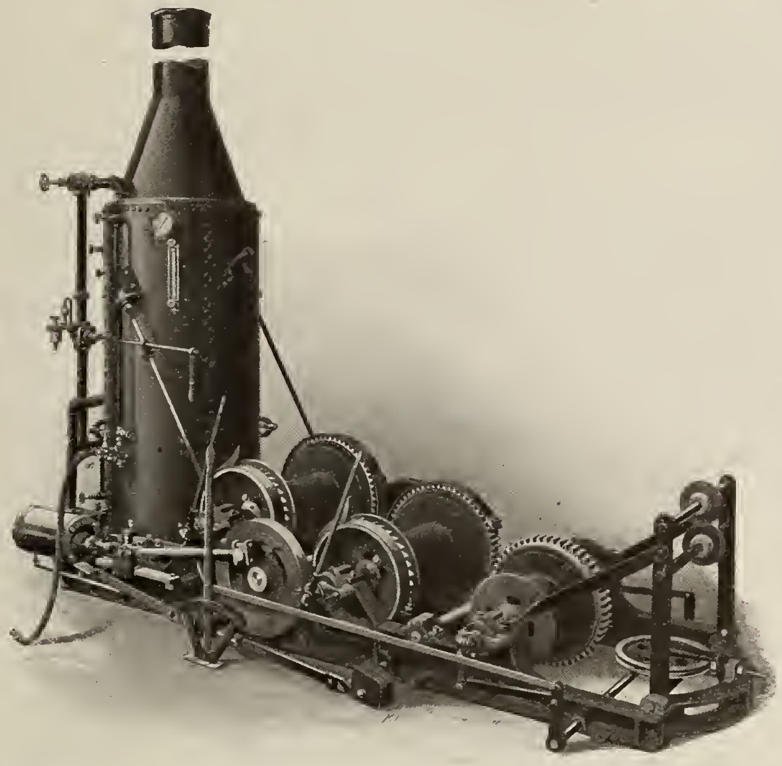

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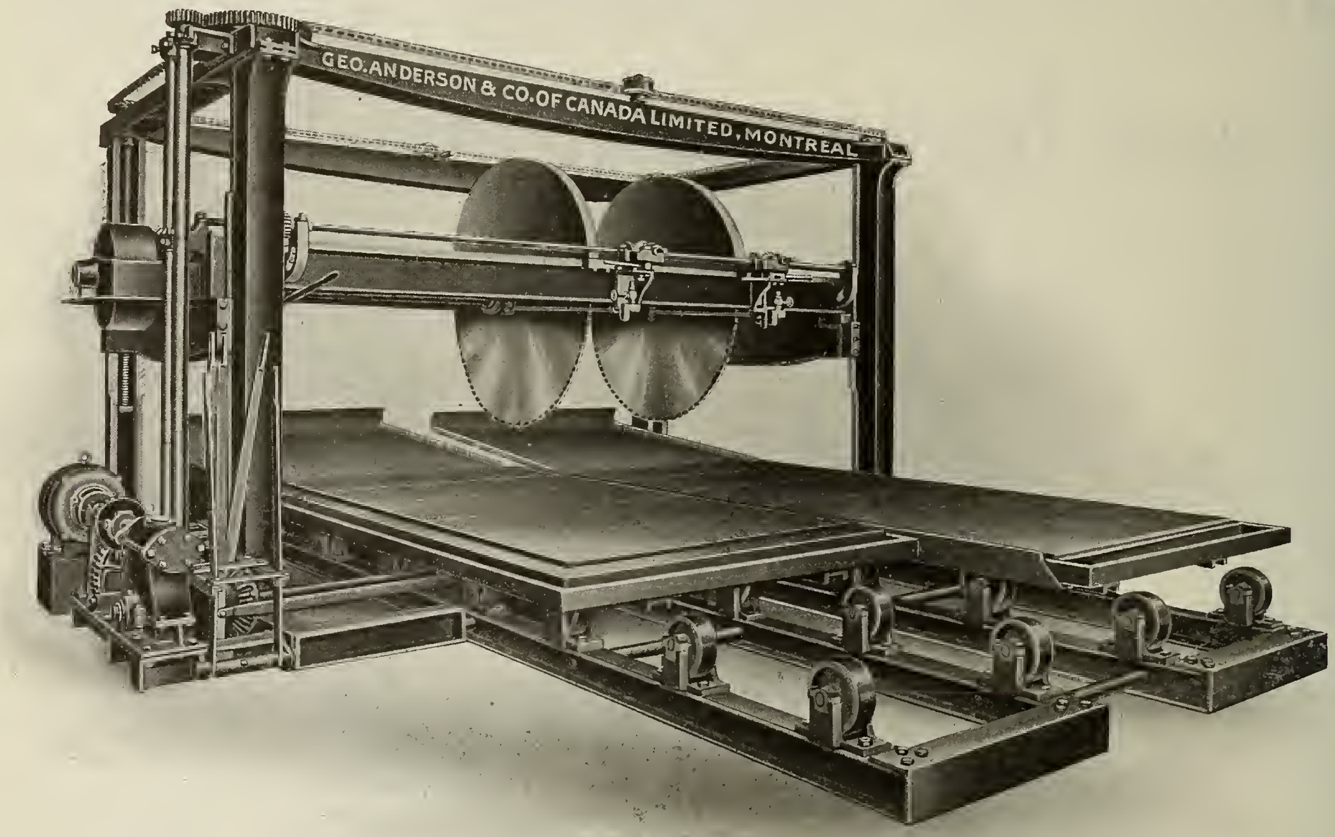
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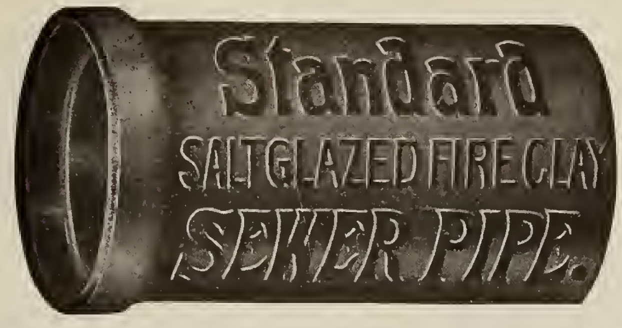

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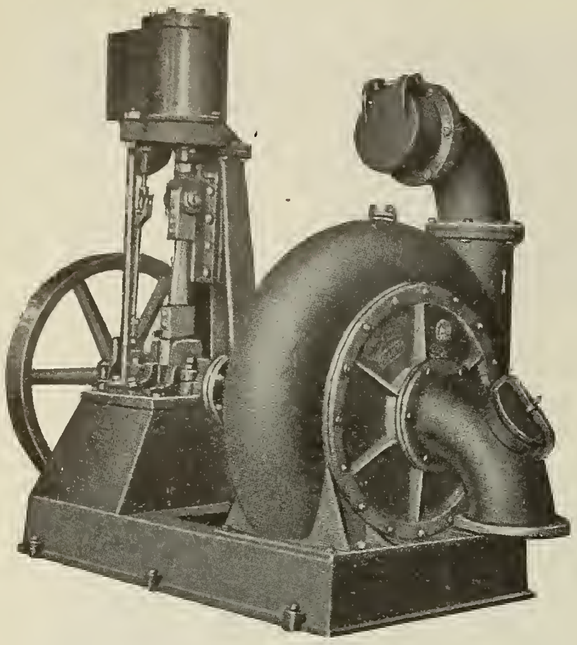

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Centrifugal and Turbine Pumps for Every Service

MORRIS MACHINE WORKS - Baldwinsville, N.Y.

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Crushed
Stone ....Cu. Yds
For Concrete or Road Construction

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Cement ....Bbls.

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HEATING CONTRACTORS FOR THAT WELL KNOWN FIRM

The Nobis Engineering Co.

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GET THE NOBIS HABITS AROUND YOUR POWER PLANTS

A Product Without a Peer

COPPER-BEARING STEEL SHEETS

BLACK GALVANIZED

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Send for a copy of "Scientific American," giving authoritative information regarding the alloy of Steel and Copper. It will be interesting and useful to you if you are using Black or Galvanized Sheets.

UNITED STATES STEEL PRODUCTS COMPANY

NEW YORK, U.S.A. Branch Offices, WINNIPEG AND VANCOUVER

SELLING AGENTS FOR EASTERN CANADA:

B. & S. H. THOMPSON & CO. LIMITED

Transportation Building
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Sewers and Culverts

properly built of properly made

Reinforced Concrete Pipe

LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

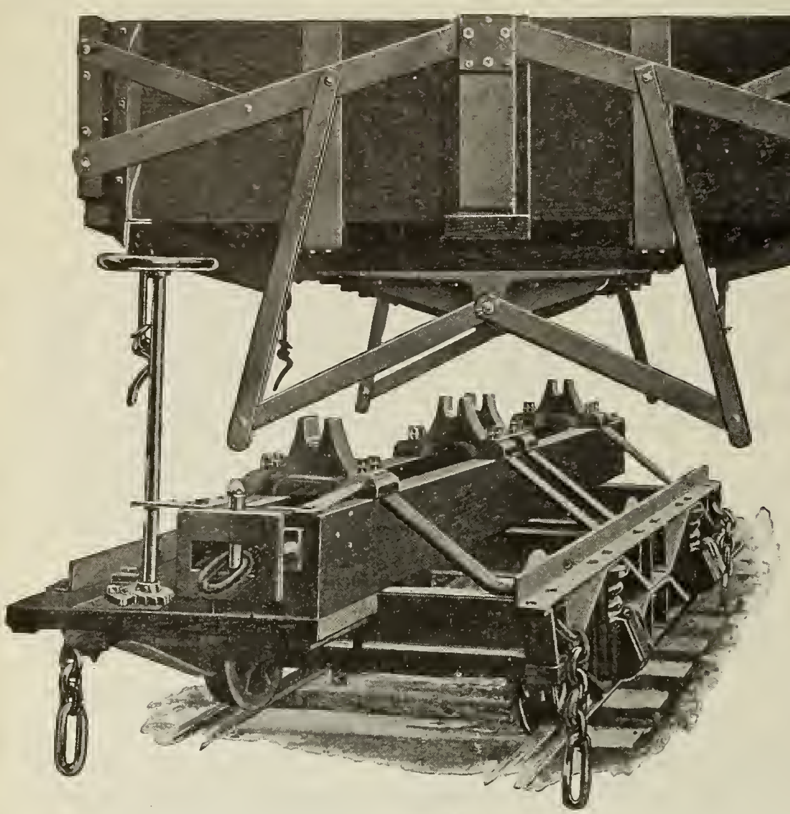
STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application

Dominion Concrete Company Ltd.

Kemptville, Ontario



Cut of 4 and 6 yard Double Diamond Steel Frame Car showing how easily they are handled

GLENGARRY

This is a Clean Lift

The feature which all our cars possess, of being able to be handled like this when loading or unloading, or for putting back on track if a run-off should occur, is one which should appeal to a practical man. The entire box and dumping irons are removable immediately as shown, making less hard work and lifting. Cars are easily transported this way. No pins to loosen up or stick. The carrying bar is held fast and drops into place easily.

This is a feature which has been much appreciated.

The Schell Foundry & Machine Co., Limited, Alexandria, Ontario

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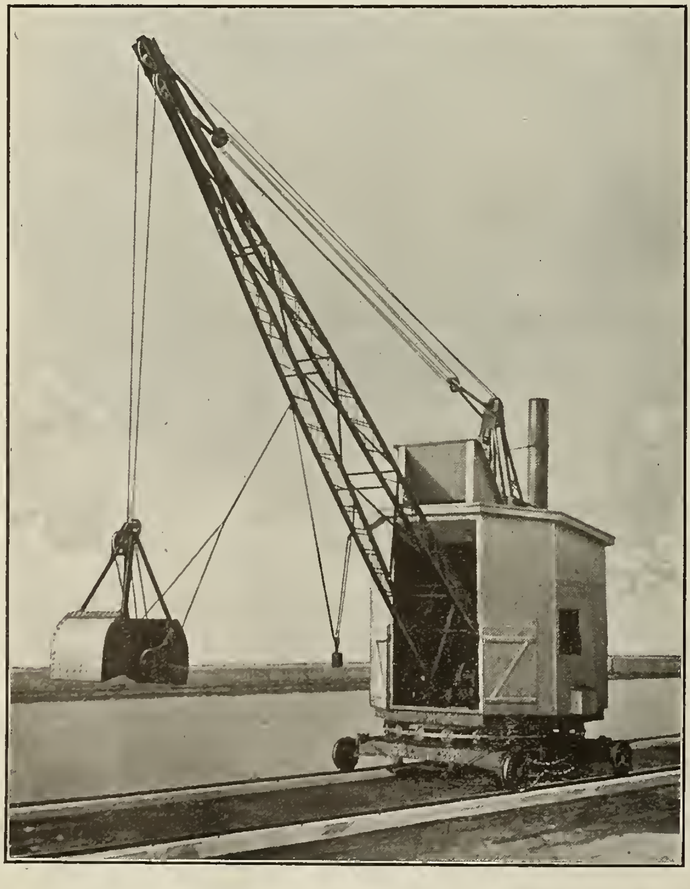

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BEATTY

Travelling and Revolving Derrick

Fitted with a
"FAIVRETTE" TYPE "C"
Clamshell

Our 1914 catalogue illustrates and describes BEATTY HOISTS. Excavating and Handling Equipment for use on land and water.

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STEEL FLORETYLE
FOR LONG SPAN CONSTRUCTION

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Head Offices and Works: Walkerville, Ont.
Branches Everywhere

Central Locomotive & Car Works

Largest Rebuilders of Railroad and Contractors equipment in America. Operate Two Extensive plants near Chicago. Have filled Large Orders of Equipment for Canadian Contractors.

We carry in stock **Locomotives of all types, Flat Cars, Center, Side** and **Air Dump Cars, Box** and **Gondola Cars.** Can make Prompt Deliveries. Prices Low.

Write for Specifications and Quotations on anything you need.

Central Locomotive & Car Works
410 Fisher Building Dept. S
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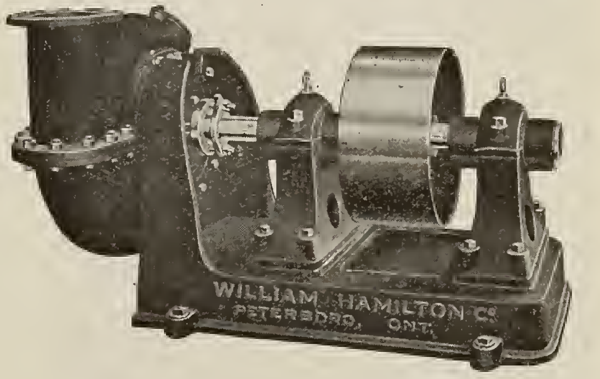
$45. GARROW
Contractors Acetylene Flare Light

The great feature of this new light is strength and simplicity. The light is constructed of steel assembled by the Oxyacetylene Welding Process and consists of three parts. It is made to stand the roughest handling by unskilled labor without injury. A distinct advantage of the Garrow Light is its use in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame.

$45.00 F. O. B. Sudbury

The
Sudbury Construction & Machinery Co., Ltd.
Sudbury, Ont.



Contractors' Pumps

These pumps have been specially designed for contractors' use. They are made for belt, direct engine or motor drive.

They have special features not found in any other pumps, notably the horizontally split shell and the wide spacing between pulley and bearings.

They are built in all sizes from 2-in. to 14-in. discharge.

Ask for pump bulletin.

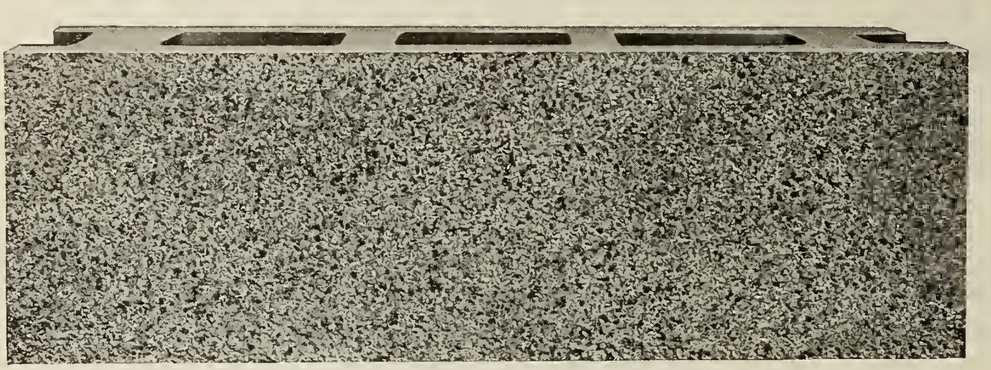
William Hamilton Company
Peterborough, Ontario

Zagelmeyer System

OF CASTING

Hollow Cement Building Blocks

With Granite Faces



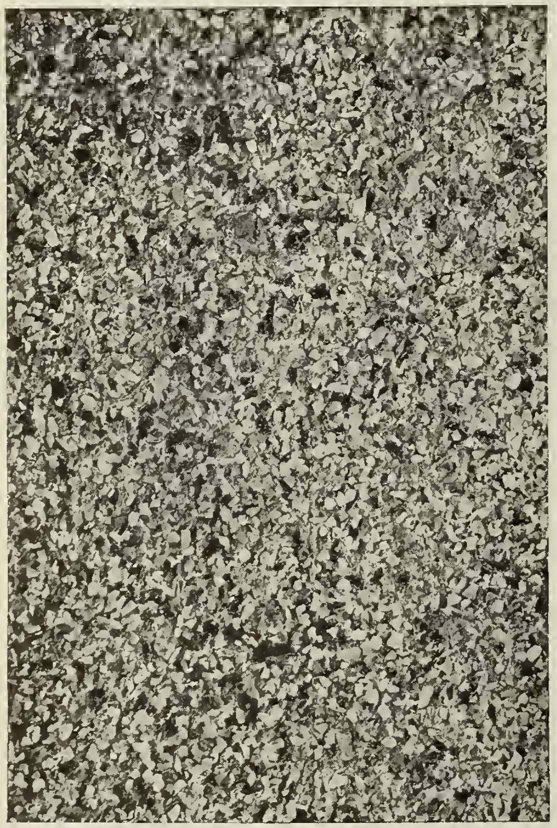
8 x 8 x 24 inch Granite Smooth Face Block

They cost less

They sell for more

You sell more of them

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



Enlarged View of Granite Smooth Facing

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold or moisture.

8 x 8 x 24 inch Granite Rock Face Block

Send us fifty cents and we will send, freight prepaid, to any point in Ontario, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

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What show will you have if your competitor secures the exclusive right for this system in your city?

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Get into a business that is protected. Then you will make money.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Canadian Zagelmeyer Co.

Limited

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WELL DRILLS are not **BLAST-HOLE DRILLS**

This is an age of specialization—Contractors and Quarry Operators who use Armstrong Special Blast-Hole Drills do so because the "Armstrong Special" is designed exclusively for drilling BLAST HOLES—NOT WELLS.

"Armstrong Special" Blast-Hole Drills are not well drills. We build well drills and have been since 1867, but we know, as do scores of successful contractors and quarry men, that well drills are not designed for and will not stand the grief of blast-hole drilling (a comparison of machines which have been in operation for a reasonable period of time will convince you). Behind our knowledge is fifty years of drill building experience—behind the experience of users is the knowledge that ARMSTRONG machines are not only more efficient but the repair, operating and "upkeep" expense is much less, due to the fact that

The Armstrong Special Blast-Hole Drill is the only Cable Blast-Hole Drill designed exclusively for Blast-Hole Drilling

That is why it accomplishes more for the Contractor and Quarryman than any machine of any other type

Every working part of the "ARMSTRONG" Special Blast-Hole Drill is designed with direct reference to hard rock drilling The "ARMSTRONG" spudding beam —the most important feature—gives a quick, sharp, springy blow that drills more holes at less cost than any other. The "ARMSTRONG" raises the tools as fast as they drop and *does not allow the tools to rest at the bottom of the hole* as in the case of well drills.

If we can prove to you that the "ARMSTRONG" will drill blast holes cheaper and better than any other machine, you surely want to know it. All you have to do is send a postal asking for proof of "ARMSTRONG" Special Blast-Hole Drill superiority, and address today to

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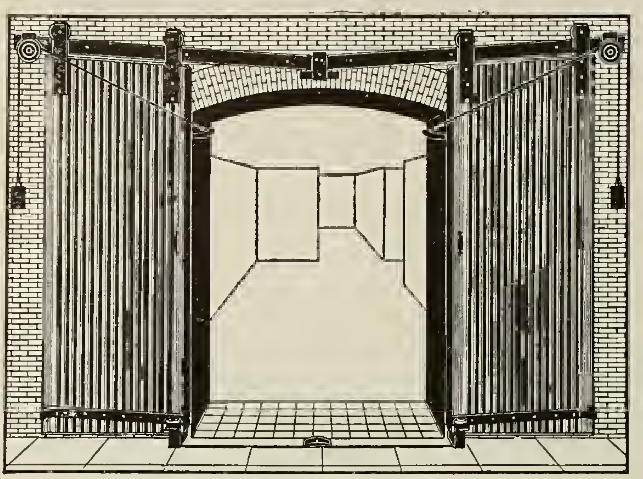
MFG. CO. WATERLOO, IOWA, U.S.A.
BUILT FOR SERVICE
SINCE 1867



Why use a Wood Door

to protect your property from the effects of FIRE, when you can buy an

All-steel, heavily-constructed

Saino Fire Door

for just about the same price.

Get our booklet 22-C.R. on Fire Doors. We make all styles and use the latest, approved trimmings.

THE SAINO FIRE DOOR is fully approved by underwriters' laboratories.

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Established 1861
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Makers of — Skylights, Ventilators, Metal Buildings, Roofing, Siding, Metal Ceilings, Etc.
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Hull Iron & Steel Foundries, Limited

HULL, - QUEBEC

Manufacturers of

"Adamantine,"

Chrome and

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Steel Castings

(Annealed and Unannealed)

TRADE MARK

Machine - Moulded Gears up to 16 feet. Grey Iron, Semi-Steel, Brass Bronze and Aluminum Castings.

Cement Mill Machinery

Our Specialty

- Tube Mill Feeders
- Griffin Mill Roll Heads
- Ball Mill Plates for Krupp Mills
- Kominuter Plates for Smidths Mills
- Steel Balls for Kominuters
- McCaslin Conveyer Wheels with "Coplan" Self-Lubricating Bushings
- Lining Plates for Bonnot Tube Mills
- Parts for Bonnot Pulverizers
- Screw Conveyer Bearings
- Eccentric Hubs, Crusher Heads and Concave Strips for Gates Crushers
- T. M. Revolving Feeders (new style) for Gates Tube Mills

Patterns for all these lines kept on hand.

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"LIQUID KONKERIT" PRESERVES AND BEAUTIFIES BRICK AND CONCRETE WALLS

"Liquid Konkerit" fills the pores and prevents the penetration of moisture, it makes old walls look like new and new walls retain their fresh appearance indefinitely.

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Canadian Billings & Spencer, Limited

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B TRADE MARK

Structural Wrenches—
Drop forged—Standard

Welland, Ontario

TENDERS FOR WORK

We would be pleased to submit prices on timbers of any description for building

Tugs Dredges Scows
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It would be entirely to your advantage to have competitive prices on your requirements, and to have our prices even if only as a matter of record.

OUR MILLS RUN ALL WINTER.

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Sash Weights
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Cast Washers

Manufactured by
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Engineers and Contractors

Buildings and Construction Work
OF ALL KINDS
Reinforced Concrete a Specialty

Write us for preliminary plans, estimates and photos of our work.

247 Confederation Life Building, TORONTO, ONT.

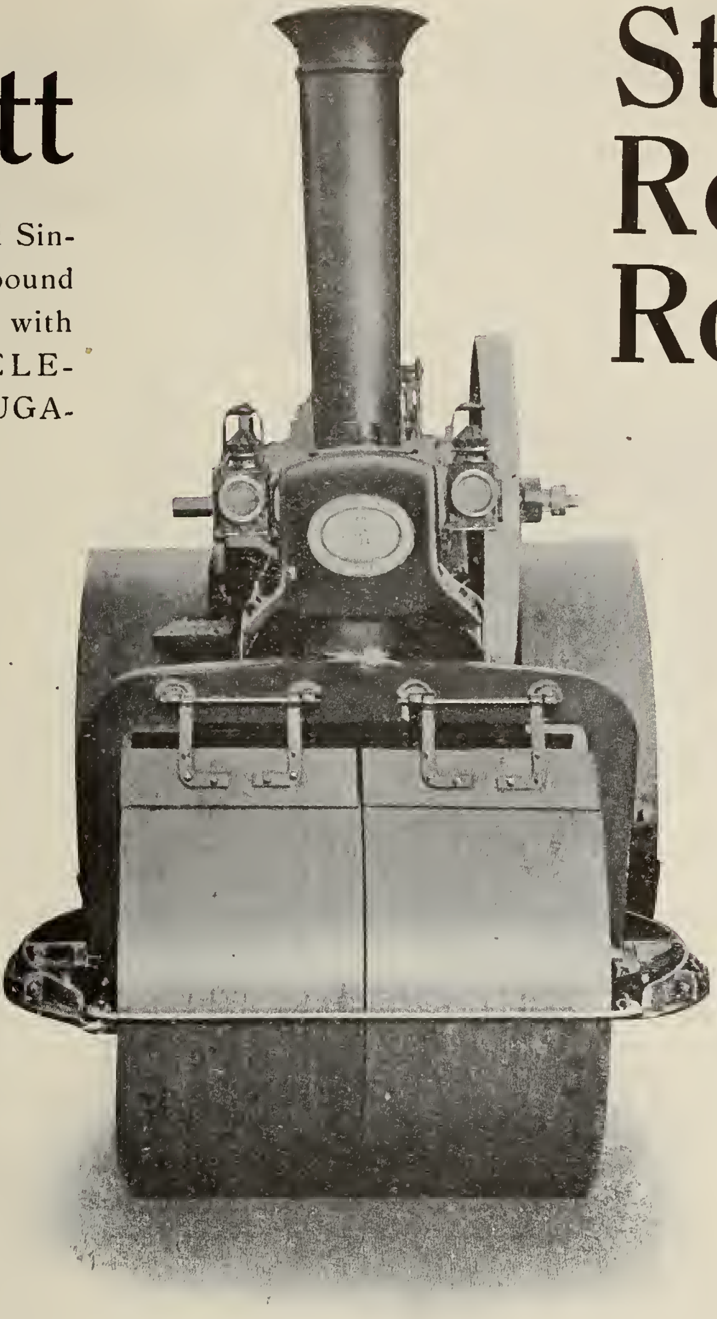
The Garrett

Steam Road Rollers

WRITE FOR CATALOGUE

The BOILERS of all Single Cylinder and Compound Rollers are fitted with GARRETT'S CELEBRATED CORRUGATED FIREBOX of exceptional durability, whereby an important economy in fuel consumption is effected and the steaming capacity of the boiler is increased, rendering our Rollers unsurpassed for rolling up steep gradients.

The steam working pressure of Single-Cylinder Rollers is 140 lbs. per square inch and of Compound Rollers 160 lbs. per square inch.



Single Cylinder and Compound—Sizes 6-20 Tons
also made Combined Road Roller and
Traction Engine

The following OUTFIT is provided with all our Rollers, Single-Cylinder and Compound.

Waterproof cover of best Willesden cloth, one pair large head lamps, tail lamp with red and white sliding shutters, water-gauge lamp for night work, tool-box with all necessary spanners, hammer, caulking tool, oil can, fire irons, tube brush, set of frost pegs for hind rollers, etc., etc.

Richard Garrett & Sons, Limited, England

Address all inquiries to our Canadian Representatives :

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Wooden Water Pipe

Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed. Prompt attention to inquiries.

Write for prices.

Manufactured by

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P.O. BOX 915

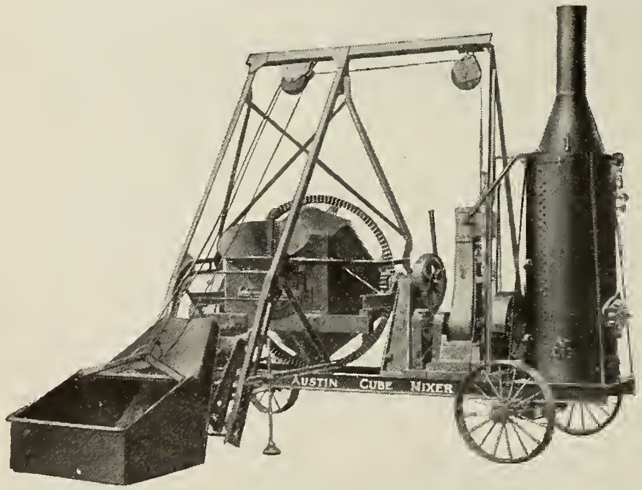
Factory: 550 Pacific St., VANCOUVER, B. C.

Concrete for the Los Angeles Aqueduct was mixed in Cube Mixers

The Los Angeles Aqueduct, one of the world's projects that ranks in importance with the Panama Canal, cost $23,000,000. An immense mass of the ***highest quality concrete*** was required in its construction—and practically ALL of this concrete was mixed by the AUSTIN CUBE. It is significant that on the world's biggest concrete jobs engineers choose

The AUSTIN Cube Mixer

It's peculiarly significant when you stop to consider the requirements of concrete mixing on work like the Los Angeles Aqueduct, the Sweetwater Dam, the Detroit River Tunnels—on SUBAQUEOUS work—all AUSTIN work.



Such under-water and water-carrying construction tests out the quality of the concrete mix, its uniformity, its denseness, more severely than does any other work.

At the same time, concrete records for speed of production must be kept up—the job must pay from the labor point of view. Engineers want speed as well as QUALITY—and for that reason the Austin CUBE is called upon.

Everything goes to prove that the Austin Cube principle is right.

Not only is the principle correct, but the charging, driving, discharging and delivery systems are also noteworthy for power economy and for speed. Three batches of perfect concrete to two of any other mixer's is an Austin record that has been made many, many times.

Write to our Canadian Representatives—the one nearest you

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The PROTECTION & DECORATION of CEMENT CONSTRUCTION
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Architects, Engineers and Builders

should know that NOW IS THE TIME TO COAT and thus protect CONCRETE and STUCCO SURFACES for the winter with

Bay State Brick and Cement Coating

This book tells you how to protect concrete and cement against moisture and shows you the wide range of such construction on which it has been successfully used. It is really a picture book of the best concrete construction all over the country. Send for this Booklet No. 10 today. It will help you to make your construction more permanent and your architecture more beautiful.

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Paint and Varnish Makers and Lead Corroders

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TUEC STATIONARY VACUUM CLEANERS

The TUEC carries all the dirt through 2½ inch pipes into a sealed tank in the basement and exhausts the germ-laden air outside the house instead of through a clogging cloth sack back into the rooms. It does the largest amount of work in a given time, at the minimum of labor and of power.

Every part of the Tuec is manufactured in the largest plants in the world devoted exclusively to the stationary cleaner business. Every part is fully guaranteed by the makers. No repairs are necessary and the first cost is the last.

It is made in Canada.

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J.O.B. CONTRACTORS PUMPS

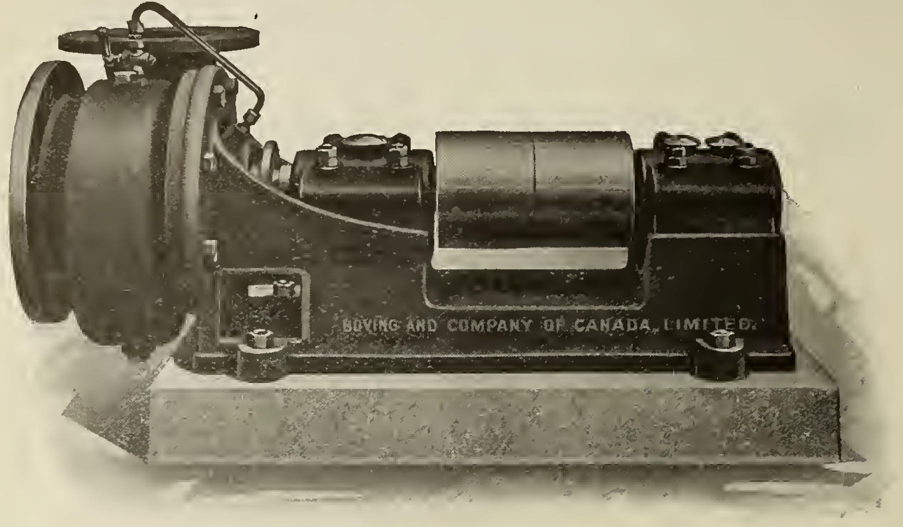

Illustration shows 10″ Contractors Pump.

Belt Driven Low Pressure Pumps of Solid and Durable Design — Built for Heavy Duty.

Let Us Quote on Your Requirements

Pumps for all purposes
- Belt Driven
- Direct Connected
- High, Medium and Low Pressure

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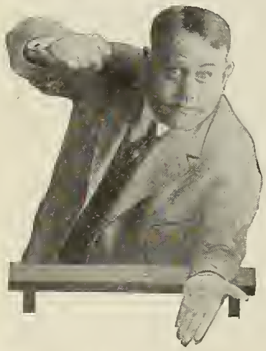

Rosebery says:
"INTERNATIONAL" in the end—why not now?

Superior Construction

It spells longer life, less repairs, no breakdowns, constant service, greater output, and lower operating and mixing cost. On the next job use the

"INTERNATIONAL"

Concrete Mixers

GLOBE TYPE

Some New Improvements worth investigating:

Globe Drum Steel Tracker Bands, Self Oiling Winding Drum and Tracker Wheels, Steel Chain Drive

Write to-day for complete Catalog No. 60-98 and prices.

Power & Mining Machinery Co.

MILWAUKEE, Wis., U.S.A. ***Factory:* Cudahy, Wis.**

Agents wanted in open territory. M325.4

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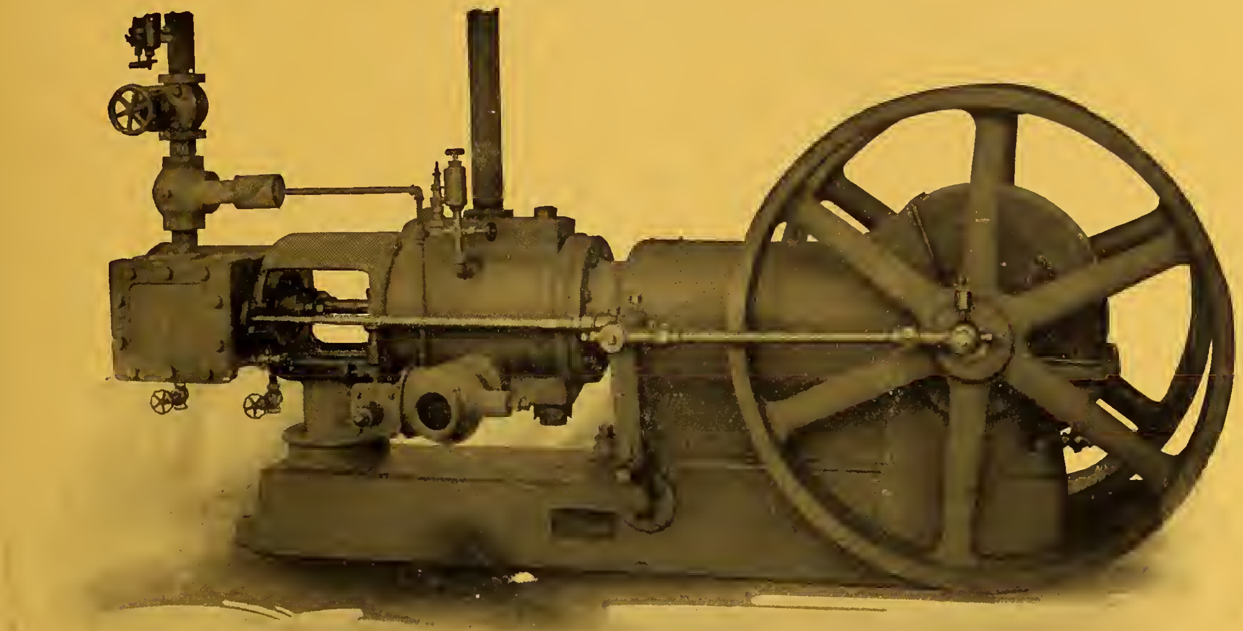


WHEN you buy your air compressor you want a machine that will deliver the maximum of compressed air on the minimum of power, over long periods, without delays. It really matters very little to you what the mechanical details are like so long as you get 100 per cent. value for your money and 100 per cent. satisfaction from your machine.

What you want most is a reliable machine with practical refinements, such refinements as will save power, minimize attention, increase efficiencies and reduce the cost per cubic foot of compressed air delivered.

Now Ingersoll-Rand compressors embody simple, efficient valve designs; properly proportioned cylinders; adequate cooling system; copious flood or bath oiling systems; large carefully proportioned bearings, well balanced rotating and reciprocating elements; all incorporated in a superior general structure carefully designed to reduce friction and vibration to the practical limit.

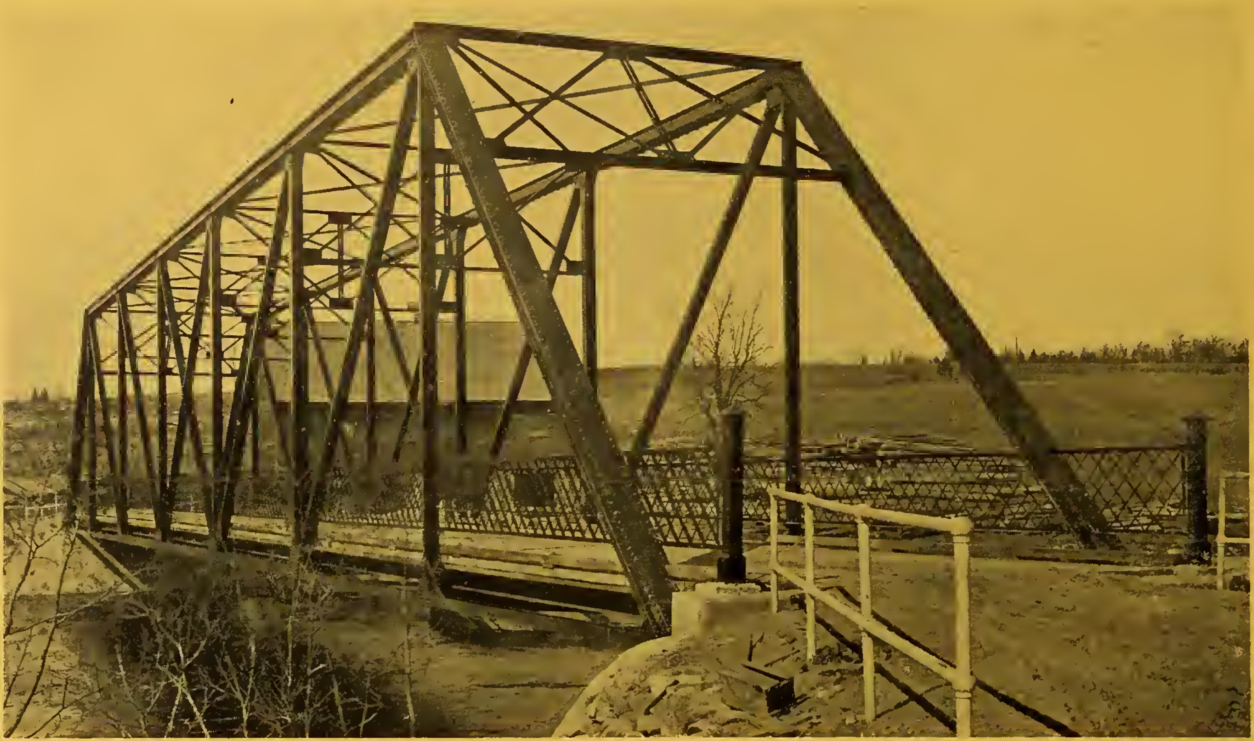
Volumetric, compression, mechanical and cooling efficiencies are all guaranteed by the Company's reputation and the ultimate cost per cubic foot of compressed air delivered is lower with Ingersoll-Rand compressors than with other makes.

ROCK DRILLS, HAMMER DRILLS, CORE DRILLS,
BLAST HOLE DRILLS, PNEUMATIC TOOLS,
SHEET PILE DRIVERS, PUMPS—CENTRIFUGAL and PISTON

CANADIAN INGERSOLL-RAND CO., LIMITED

COMMERCIAL UNION BUILDING, MONTREAL, CAN. - WORKS: SHERBROOKE, QUE.

Sydney, Montreal, Toronto, Cobalt, South Porcupine, Winnipeg, Lethbridge, Nelson, Vancouver



Bridge of 166 ft. span, erected by us over the Little River Nicolet, at Nicolet Falls, Que. One of the many permanent structures being built by up-to-date Municipal Councils throughout the Province of Quebec.

Truss, Beam and Girder Bridges
Mill, Office and School Buildings
Tanks, Hoppers, Penstocks and Smoke Stacks

Miscellaneous Structural and Steel Plate Work of Every Description.

Write us for prices. Estimates cheerfully furnished.

MacKinnon, Holmes & Company, Limited
Sherbrooke, Que.

SHERBROOKE

QUEBEC

A CITY OF INDUSTRIES

Sherbrooke's Claim

The city of SHERBROOKE sends forth a claim as an industrial centre and SHERBROOKE has her reasons :

Mr. Manufacturer :
Mr. Capitalist :

Consider these five and then let us tell you others :

POWER

SHERBROOKE owns and controls at her very door and even within her limits **10,000 Horse Power** already developed. She owns besides 4,000 H.P. still undeveloped. ¾ per cent. per "kilowatt hour" is the price to manufacturers' being $16.70 per H.P. per annum based on a 10 hour day.

(See next page)

Write : E. C. GATIEN,
City Treasurer
or J. J. FITZGERALD,
Industrial Commissioner
SHERBROOKE BOARD OF TRADE

Part view of Canadian Ingersoll-Rand Co.'s plant.

SHERBROOKE

QUEBEC

HAS THE POWER AT HER COMMAND

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Favorably located in the heart of the Eastern Townships famed as the "Garden of Quebec" SHERBROOKE is served by the Canadian Pacific, on the main line between Montreal and Halifax; the Grand Trunk on the main line between Montreal and Portland and Quebec and Portland; the Boston and Maine giving direct communication to all New England points and to New York City. The Quebec Central Railway besides giving quick service to various points in the province makes important direct connections with the Maine Central and the Intercolonial Railway.

Here is an illustration of SHERBROOKE'S accessibility:

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Montreal	3½ hours	Toronto	12 hours
Quebec	6 "	New York	12 "
Portland	6 "	St. John, N.B.	12 "
Ottawa	6½ "	Halifax, N.S.	22 "
Boston	10 "	Winnipeg	51 "
Springfield	10 "	Vancouver	120 "

(See page 41)

Write: **E. C. GATIEN,**
City Treasurer
or **J. J. FITZGERALD,**
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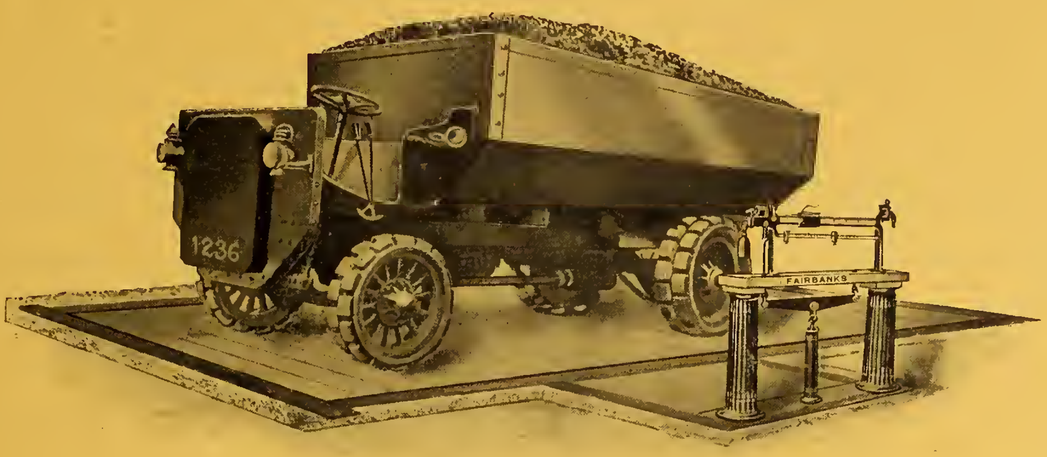
SHERBROOKE BOARD OF TRADE

The Power Behind Sherbrooke—One source of Sherbrooke's power.



2% variation from true weight is very common in cheap scales. Figure 2% of the value of material weighed over our scales and you will understand why we say you cannot afford to take any chance with a cheap scales.

Fairbanks Scales made accurate weighing possible and are still leaders of the world after having been the World Standard for nearly one hundred years.

Hardened Steel Knife Edges, properly ground and accurately located; the best of materials and most careful workmanship are the force behind the excellent reputation of Fairbanks Scales.

They are bound to make good and will give accurate results for many years.

Put your weighing problems up to our experienced Scale Experts.

It will cost you nothing and the information which we will send you, will undoubtedly be of inestimable value to you.

Made at Sherbrooke, Que.
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MEXICAN EAGLE ASPHALT

TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications.

Purchase MEXICAN EAGLE ASPHALT because:

TRADE MARK

1—It is more cementitious than other asphalts.
2—Water will not readily injure it.
3—Exposure to sun and air will not cause its deterioration.
4—It has great cohesive strength.
5—It is more ductile and flexible than other asphalts.
6—Shocks will not crack it. It is very malleable.
7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow and ice likely to crack it.
9—It has over 99 per cent. bitumen. Purest on the market—therefore free from deleterious matter.
10—It is so constituted that it will not be injured by the heat necessarily applied to melt it for paving operations.

Samples, prices, analyses, etc., on request.

THE ASPHALT AND SUPPLY CO. LIMITED

SOLE CANADIAN AGENTS FOR THE MEXICAN EAGLE OIL C^O LIMITED
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SHERBROOKE

QUEBEC

STEADILY AND SURELY ONWARD

LABOR SUPPLY

No manufacturers in all Canada are better supplied with efficient, satisfied labor than those now in SHERBROOKE. As new industries come in the labor is ever at hand not only from this city but from Montreal, from New England and from adjoining centres they flock to SHERBROOKE because they like to live there. **SHERBROOKE has never had a strike.**

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The supply of raw material for nearly every line of manufacture is within immediate reach. Asbestos, copper, silver and iron mines are in the immediate vicinity. Rich pulp and lumber deposits are found in close reach.

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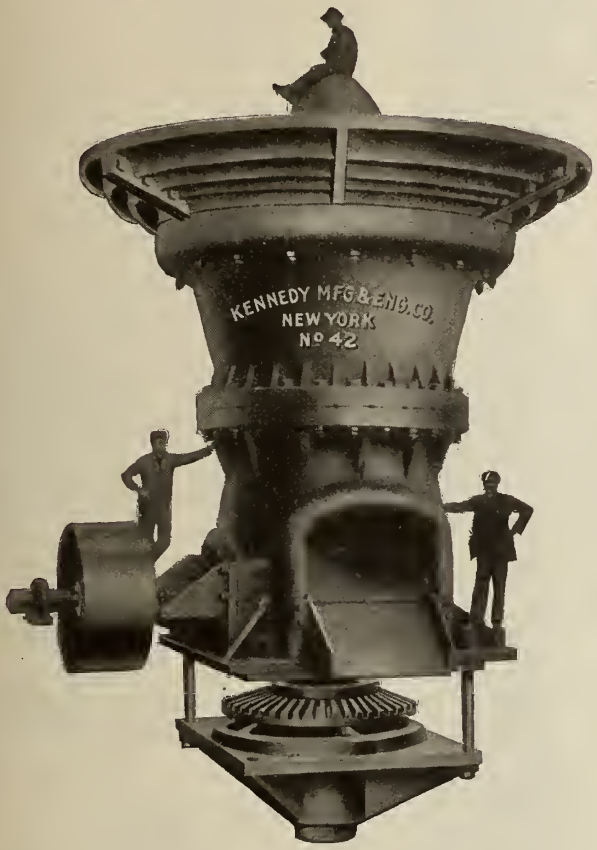
Sherbrooke, from East Sherbrooke, showing Aylmer Bridge.

Kennedy Gyratory Crusher



THIS cut illustrates the Kennedy Gyratory Crusher No. 42 which is now being installed on Section No. 3 Welland Canal, and which with its four supplementary smaller Crushers and general equipment will be the largest and most complete Crushing Plant yet erected in Canada.

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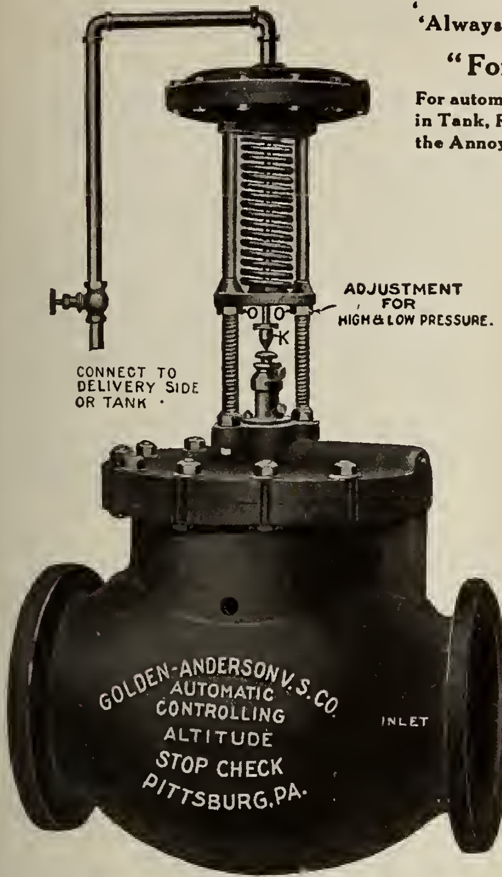

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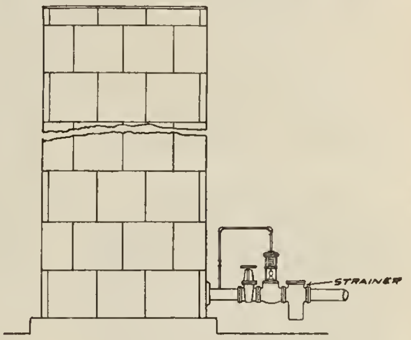

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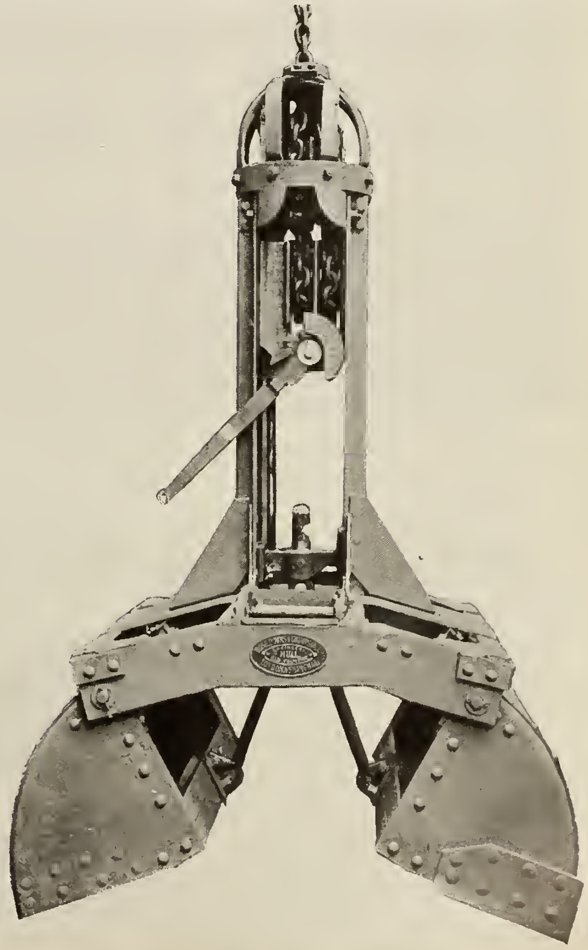

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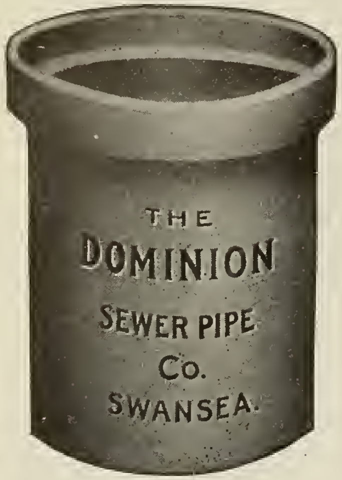

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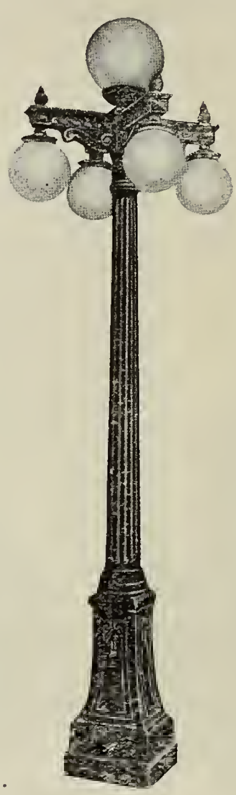

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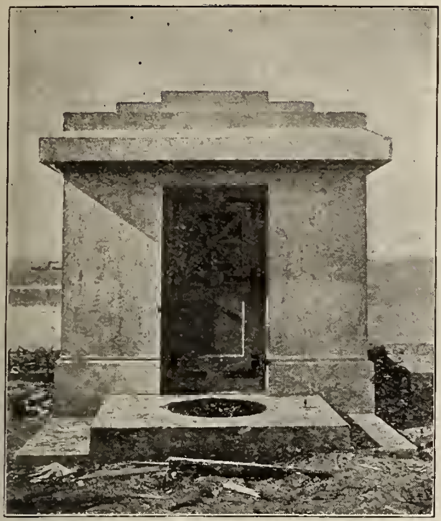

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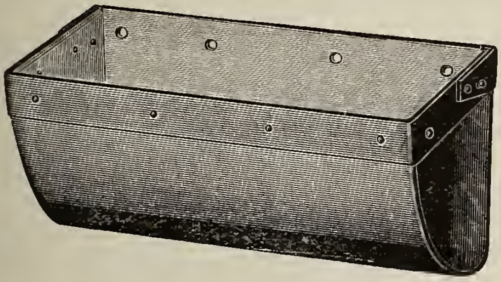
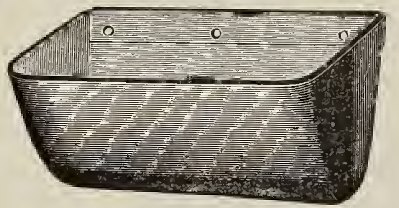
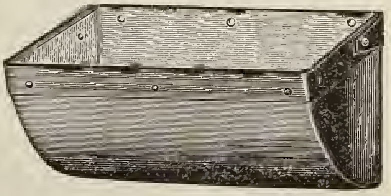


Buffalo Elevator Bucket



Salem Elevator Bucket



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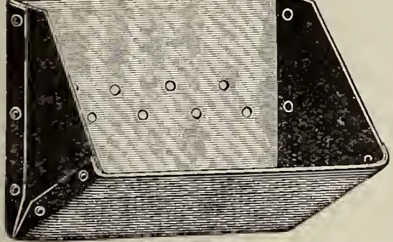

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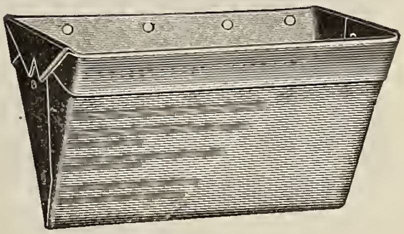

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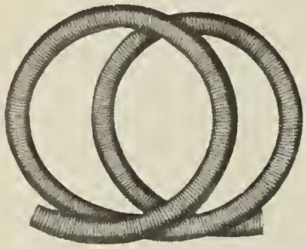

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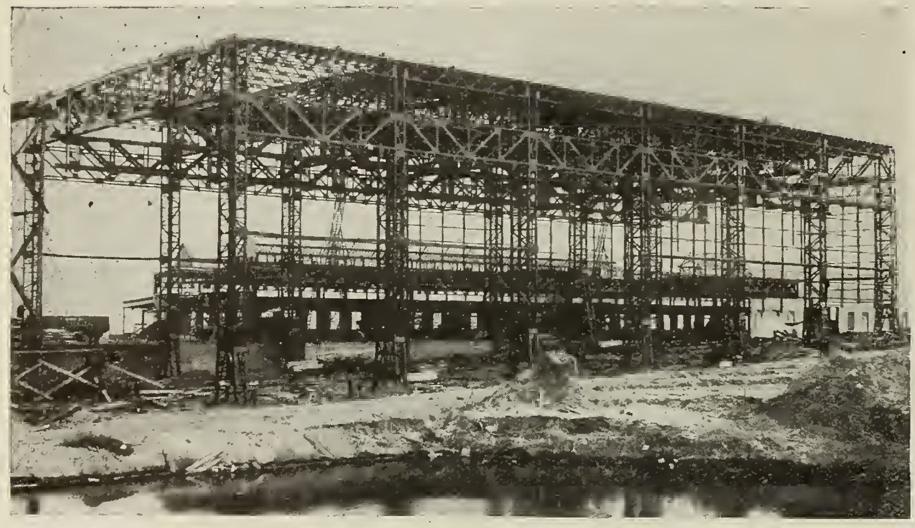

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The Human Factor in Depreciation

THERE is one phase of municipal depreciation which has not received the attention it demands. In our recent Annual Number there appeared an admirable article, "Depreciation in Relation to Municipal Works," from the pen of Mr. R. O. Wynne-Roberts; but, as its title implied, it did not go beyond "works." The human element was not considered. The workman, the clerk and the professional man depreciate precisely as do the works for which they are responsible. Each of them is a "public utility," and all are important integers in municipal trading. Says Mr. Wynne-Roberts "municipal ownership entails great responsibilities, not only to the ratepayers and the patrons, but also to the investors. Efficiency means maintaining a department at a top-notch condition and the service at the same time rendered at a reasonable cost, whilst economy is often interpreted as a reduction of expenses to an excessive degree. Physical depreciation is influenced by these factors in a tangible measure, for if any plant is not maintained efficiently, then its value quickly falls and this in turn then affects the investors' interests and may also in time raise the price of the commodity produced or the service rendered." One might vary the statement by the substitution of the word "staff" for "plant," and it is obvious, too, that plant can be maintained efficiently by none but an efficient staff.

It is unfortunate that advanced civilization tends more and more to an utter disregard of the individual. He becomes merely a bolt or a nut in a complicated piece of machinery and may be replaced at will. His demission may cause a temporary stoppage or even a breakdown, but he is soon replaced and the machine goes on as well as before. There is a popular fallacy to the effect that an individual costs nothing. A horse or a cart represents a certain definite capital outlay, and if the one is injured or dies or the other is damaged in any way cash is necessary for replacement. Hence the necessity of a depreciation fund. But the reasoning is false. The expense of the ordinary individual—the worker, that is, of every grade—amounts to a goodly sum. For many years he has to be housed, clothed and fed without return, and the cost of this must fall ultimately upon the workers of the nation. "Who are you working for now?" a man once asked another, and the reply sums the whole matter up. "Who am I working for? Why, the same people—the wife and kids." A man must be paid at least as far as his absolute needs, and those needs include the maintenance and upbringing of his "kids." Hence he requires a proportionately fuller reward for his labours, and the nation has ultimately to back the bill for this. Even a millionaire's child depends for its existence upon the workers, although maybe it is the workers of all nations that contribute in amounts proportionate to the father's investments.

Let it be conceded then that the individual is as entitled to participate in a depreciation fund as is a sewage-pump or a dynamo. The whole time that the pump or the dynamo is at work a certain sum is being laid aside for its renewal when scrapping day arrives. In the case of the individual—and it is to be noted that in using the word "worker" we have used it in its very broadest sense—no such provision has been made. He is relegated to the scrap heap without a thought for his declining years, and a younger man takes his place. But without the older man the younger would not have been there. The older man absolutely provides the new machinery, in full working order. Emerson said: "The true test of civilization is not the census, nor the size of cities, nor the crops —no, but the kind of man the country turns out"; and it is the older man that is responsible for the "turning out" (for good or for evil of the younger). Confining our remarks as we have to the municipal aspect of the question, the men whose life-work consists largely of training the younger generation and fitting it to replace them, when their faculties (physical or mental as the case may be) are declining, deserve well at the hands of their country. The wages or salaries paid do not leave much as a provision for old age. As has been said, it is the older generation that provides the new, and it is entitled to share in a full depreciation fund. A pump becomes useless, and a sum sufficient to furnish another is drawn from the fund. When a man becomes useless, he supplies his successor—and draws nothing. The agitation in the old country for the superannuation of municipal officials of all grades is merely a demand for the provision of a depreciation fund to be utilized for the benefit of the individual.

Composition Flooring

By R. W. Page

COMPOSITION flooring is no longer an experiment. It has "made good" and is so widely specified and used to-day that there is no question whatever in the minds of those who followed the progress of this material since its introduction abroad and in this country that it is destined to fill a definite and no insignificant field in the building industry.

The architect or engineer who has had no experience in the use of composition material, and who may contemplate specifying it for some project he has in hand, should bear in mind four factors which largely determine a successful issue. These are: Selection of material to be used; provision for adequate foundation; use of skilled and experienced labor; protection and after care of the finished work.

To refer to these points briefly:

An intelligent selection of the flooring material. Owing to the fact that manufacturers in this country hold their various formulae as trade secrets, the architect is unable to specify the precise formula for the make up of the material as he does in the case of Portland cement. When we take into consideration the fact that oxychloride cement used in all composition flooring is capable of carrying other ingredients up to 20 times the weight of the cement, we can readily see what a vast variation there may be in composition flooring, not only with respect to the number of ingredients added but also in the relative properties secured. It is quite possible, and indeed very likely, that no two floorings of two different manufacturers are essentially alike. For these reasons the careful architect or engineer will not specify merely "composition flooring." He will name only those manufacturers whose material he has thoroughly investigated and this investigation will include the inspection of work installed for some length of time so that he may see for himself just how the material will stand up under service.

Under no circumstances should the architect or engineer make his selection solely from samples submitted. All samples look very much alike. Often the impractical mixture will make up into a better looking sample than the efficient material for the simple reason it is often easier to trowel-finish such a mixture to a good even surface.

An adequate foundation should be provided for in the general specifications: A large percentage of difficulties encountered in the past has been due to the inadequate foundation. I refer to concrete foundation as wood foundation presents no great difficulty.

The concrete foundation must be of sufficient richness and under no consideration should it contain lime. Buckling or coming away from the foundation is almost always due to one or the other of these causes. Most manufacturers provide printed foundation sheets giving the proper mixture of the concrete fill and methods of its installation.

Skilled, experienced workmanship essential: Composition flooring requires radically different handling and trowelling from that given Portland or other cements. It is utterly impossible to take a workman inexperienced in the work of this material, from either a cement workers' union or a plasterers' union, and expect him to turn out a satisfactory piece of work.

Such a man would not become proficient in this line without many days of actual experience in working with this material. For this reason it is not advisable to buy the material in bulk from any particular manufacturer and plan to install it by local mechanics. Expert workmanship is of the greatest importance owing to the fact that the color appearance of the finished flooring is dependent largely upon the time and manner of the final trowelling.

Protection and after care of finished work: Owing to the liability of damage from other mechanics (composition flooring is far more liable to such damage when it has been newly installed than will be the case after it has reached its maximum hardness) this material should be practically the last thing installed in a building. In so far as it may be possible the plastering should be done, the trim set, the glazing in place, the painting done and all fixtures installed.

Composition flooring should receive the same care to prevent damage caused by other contractors that is exercised in the case of finished wood flooring. Many an excellent piece of work has been permanently marred by carelessness in this regard. Most manufacturers will leave their work well covered by heavy paper, sawdust or both.

The after-care of this material is of importance. Frequent washing and an occasional oiling will serve to keep a floor in perfect condition and with this care it has been repeatedly demonstrated that composition flooring improves in appearance as it ages under service.

A reinforced concrete pontoon, for a landing stage for ferry service, has recently been put into use in the Harbor of Sydney, Australia. The pontoon is 100 ft. long, 43 ft. wide at one end and 68 ft. at the other, 7 ft. 9 in. deep, with a 32-in. freeboard. The bottom is flat, and the sides and ends are sloped to an angle of 70 deg. Special attention was given to the design of the reinforcement, with a view to enable the construction to withstand the excessive strains likely to occur should vessels be berthing at each side of the pontoon at the same moment. In the construction of the top and bottom of the pontoon, allowance has been made for a live load of 150 tons, which will be distributed over the center length between the posts. The whole structure is divided into 48 water-tight compartments by solid reinforced-concrete walls. It weighs about 650 tons.

View of the city of Sherbrooke from the east.

SHERBROOKE

The Approaching Mecca of the Union of Canadian Municipalities— A City of Notable Constructional and Industrial Attainment— A City of Manufacturing Facilities, Enterprise and Opportunity

THE city of Sherbrooke, Que., which has been called "the Queen of the Eastern Townships," was founded nearly a century ago by Sir John Cope Sherbrooke, who, in 1816, visited the place, then only a small hamlet with some half a dozen log houses. The halmet was named after the Governor.

Time passed. A court-house was built, churches appeared on the hilltops, public biuldings were erected, seats of learning were founded, railways were constructed and banks were established—and, finally, in 1875, Sherbrooke was incorporated as a city. From that time Sherbrooke began to acquire a position of industrial importance which she has steadily maintained and improved.

An interesting feature of Sherbrooke's growth in recent years is the success with which it has carried out the idea of municipal ownership of public utilities. The first of these utilities to be taken over by the city was the waterworks, in 1897. The waterworks system has been a complete success from the beginning, The citizens are receiving first-class service at low rates, the city treasury is swelled each year by a neat profit and fire protection is properly looked after.

Improvements to Waterworks During Past Year

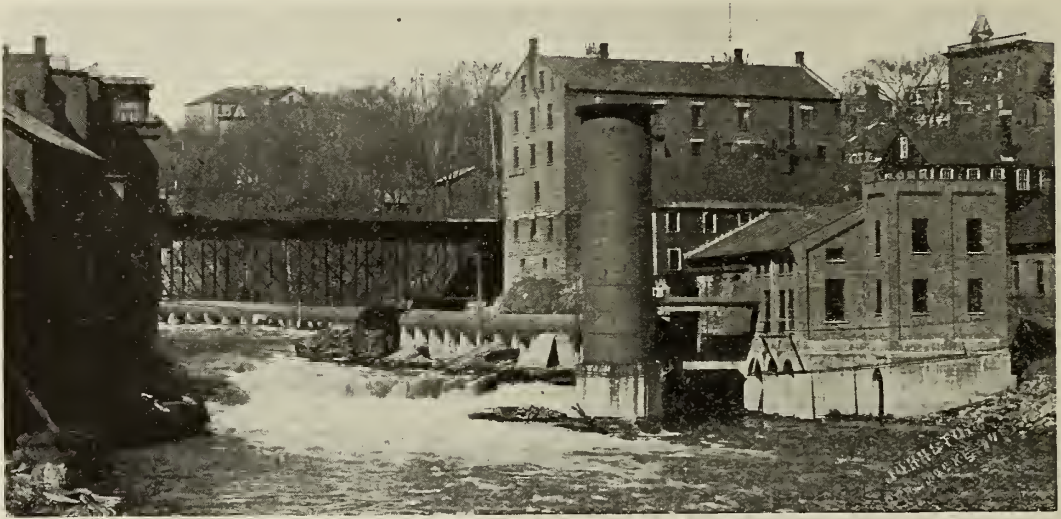
Last year extensive improvements were made to the water system. The new pumping station was built. This contains four power pumps and waterwheels with a pumping capacity of 8,000,000 gallons a day. It is estimated that this will meet the requirements of Sherbrooke until it has doubled in size. The cost of the new pumping station was $60,000. A new reservoir has also been provided. The water is forced to the reservoir over a distance of three miles through 20-in. and 24-in. mains. The elevation of the reservoir above the pumping station is 190 feet. The elevation above the commercial centre is 330 feet. This affords a pressure of 125 lbs. A stream of water from the fire hose can be sent far over the highest building. Twenty-two miles of pipe are required for the distribution system.

Power, Light and Gas

The most interesting feature of Sherbrooke's municipal ownership is the progress of the electric light and power plants. It was in 1908 that the city took over the management of the electric department. The story of its success may be set forth briefly as follows:—1908, one hydro-electric generating station; 1913, two larger hydro-electric generating stations; 1908, 2,218 customers for lighting, power or gas; 1913, 4,500 customers for lighting, power or gas; 1908, 1,398 h.p. highest peak load demand; 1913, 3,500 h.p. highest peak load demand; 1908, 94 arc lamps and 65 incandescents for street lighting; 1913, no arc lamps,

Plant of the Paton Woollen Mills- the largest of its kind in the Dominion.

A part view of the Canadian Ingersoll Rand Company's plant at Sherbrooke.



Penstock and Buildings of the Sherbrooke Railway & Power Company.

The 54th. Regiment Armory, Sherbrooke.

"The power behind Sherbrooke." Drop-off No. 1.

2,400 60 c.p. tungsten lamps. 1908—Prices: light 10 cents kw. hour; power $25 to $45. 1913—lighting, .054 kw. hour; heating, .02 kw. hour; power, .0075 kw. hour ($16.70 per annum).1908—Assets $351,365.94; liabilities $252,713; surplus $98,652.26. 1913—Assets $613,530.97; liabilities $410,124.05; surplus $203,406.92. 1908—Gross revenue $72,214.62; 1913—gross revenue $120,184.38.

The remarkable point about these figures is that while the prices of light and power have been cut down the profits have steadily grown. The plants are kept up to the highest standard. A reserve for unseen depreciation has been provided to the extent of $69,098. From the very start the department has been self-supporting. No money out of ordinary city tax collections has been invested in the department. The city now owns six powers, four developed and two undeveloped. The amount of power developed is 6,000 h.p.; undeveloped 5,000 h.p. This year the only wooden dam remaining will be replaced by concrete. The direct income resulting from the ownership of the light and power department is easily measured, but the greater indirect benefit derived from the advantage of being able to offer the lowest rates to manufacturers can hardly be estimated.

The organization of the Sherbrooke Railway and Power Company and the development which it has promoted during the last three years have meant a great deal to the city of Sherbrooke. The capitalization of the company was placed at $1,500,000 five per cent. thirty-year bonds, of which $700,000 were issued and $1,500,000 ordinary stock of which $700,000 was also issued.

The new dam is 300 feet long and is built across a rock gorge. About 3,000 cubic yards of concrete have been used in its construction. It was built in three sections—a large spillway section in the centre, and bulkhead and stoplog sections on the side. A steel plate thimble, 13 feet in diameter, is let into the bulkhead section to convey the water into the penstock. Through this the water is carried to the new powerhouse, 650 feet below, thus obtaining a working head of 63 feet. Of the 3,300 h.p. thus developed, about 500 h.p. is required to operate the street railway and the remaining 2,800 h.p. is available for industrial purposes.

The Sherbrooke Railway & Power Company's dam.

The organization was financed and put through by McCuaig Bros. & Company, of Montreal. The advantage of having this organization so closely identified with Sherbrooke is apparent becaues of its ability to interest capital in local industrial pursuits.

The opportune location of the city has always marked it as a distributing centre. Montreal, Ontario and the West may be reached either by the

"The power behind Sherbrooke." Drop-off No. 2.

Grand Trunk or by the Canadian Pacific. Halifax and St. John, N.B., may be reached via either the Canadian Pacific or over the Quebec Central via Harlaka Junction and the Intercolonial Railway. The Grand Trunk Pacific connecting with the Quebec Central offers another competing route for the lower provinces. The port of Quebec is reached directly over the Quebec Central or the Grand Trunk. Direct communication to the large centres of the New England States and to New York City is provided by the Grand Trunk and Boston & Maine Railways. Competition of transportation lines and the accessibility of the city have been great drawing-cards in inducing industries to establish in Sherbrooke.

The Bank of Montreal, Sherbrooke.

That Sherbrooke is sound as an industrial centre is evidenced by the success of its present industries. During the last few years it has established itself as an iron and metal-working centre. Among the industries of this nature are the Jenckes Machine Company, the Canadian Ingersoll-Rand Company, the MacKinnon Holmes Company, the Sherbrooke Machinery Company, the Sherbrooke Iron Works Company and the Canadian Brakeshoe Company. All these concerns, some of them recent arrivals, have been growing steadily since their establishment.

Some of these industries are unique in the nature of their work. The Canadian Brakeshoe Company is the only industry in America welding steel by electricity in electric furnaces. The Canadian Ingersoll-Rand Company has the largest shops in Canada making compressed air machinery. Its steady growth can be seen from the fact that ten years ago it occupied a floor space of 21,560 square feet, while to-day it occupies 200,000 square feet and is paying out wages to the extent of $275,000 a year compared with $45,000 ten years ago. There are upwards of two thousand men employed in the Sherbrooke metal-working industries.

Although Sherbrooke is fast becoming an important metal-working centre, its industries are not limited to this class. Its first large industry was the Paton Woollen Mills, which is still the largest plant of its kind in Canada.

The Canadian Connecticut Cotton Mills has commenced operations in Sherbrooke this summer. This is the only company in Canada specializing in the manufacture of tire duck. The main building measures 112 feet x 236 feet, two and three storeys; the picker building is 60 x 61 ft., three storeys; the boiler house 52 x 40 ft., one storey, and the storehouse 100 x 100 ft. one storey. The height of the chimney is 80 feet. The building is the most modern factory construction, well-lighted and provided with sprinkler system. The company own six acres and is already talking about expansion.

The Panther Rubber Company have also begun operations in Sherbrooke and the Whiting Davis Company, manufacturers of jewelry, have opened a plant. These last-named industries are branches of New England establishments.

Constructional Work to be Undertaken During Summer

In spite of the general depression, a good deal of construction is now going on in Sherbrooke. The

R. C. Seminary and College at Sherbrooke.

J. H. Hamilton Shoe Company is erecting a modern shoe factory and the Sherbrooke Machinery Company is doubling its capacity. The North Ward High School is being completely renovated and extended. The Bell Telephone Company propose erecting a fine new building. A new theatre and two new stores and office buildings are being completed in the commercial district.

The growth of the city during the last five years compelled the council to give attention to the inadequacy of the sewerage system, accordingly Mr. Hilder Daw, the Montreal consulting engineer, was instructed to prepare plans of a system of sewerage which would suffice for fifty years. The plans are now well advanced. A suitable site has been provided for purification purposes. The trunk main skirts the Magog and St. Francis rivers.

The program of road work this year includes three miles of penetration pavement to be constructed as follows: 12 ins. rubble stone; 4 ins. of 3-in. macadam stone treated with 1 1/5 gallons Tarvia X; 2 inches of 1½-in. stone treated with 1 gallon Tarvia X with a top dressing of ⅜-in. crushed stone.

The Eastern Townships Exhibition is held in Sherbrooke every year and attracts thousands of visitors to the city.

A Town Planning Scheme: Its Effect on Housing and Architecture

(By Raymond Unwin)

THE essential parts of a town planning scheme were considered in detail in an interesting paper read by Mr. Raymond Unwin at a recent meeting of the Institution of Municipal and County Engineers, at Dunfermline, Scotland. Mr. Unwin is well-known as one of the leading town planning experts of the old country, and although his observations will be found somewhat "English" in regard to the more superficial questions of local practice, the underlying principles of his discussion contain much that should be found suggestive by all identified with civic improvement in Canada. The paper is slightly abstracted, but it contains so much solid matter that any promiscuous cutting would be out of place. We therefore present the paper in extenso.

To quote Mr. Unwin:

A town planning scheme consists of two parts. There is first a plan, and second the text of the scheme, which includes a series of regulations of the nature of by-laws covering a very wide range of subjects, which may be independent of the plan, or may consist of interpretations of the plan, or regulations which take effect in particular areas defined by the plan. The effect of the scheme therefore depends on the constructive meaning of the two parts read together, and it will only to a limited extent be possible to deal with the parts separately. So far as it is possible, however, it may be well to take the plan first.

There are certain considerations in connection with it which appeal strongly to the architect, whether he is considering the effect in architecture as a whole, or the effect on the domestic branch which we have summed up under the word "housing." The architect's special point of view may perhaps be stated by saying that he looks upon the scheme as a design; as something thought out as a whole, aiming to produce some definite total effect which will depend on the relation and proportion between the different parts. A design must not, however, be taken to mean merely a pretty picture on the paper. Many natural features of the site, many existing conditions, such as the position of railways, waterways, roads, or buildings, will determine the planning, and will very often prevent that symmetry and balance over large areas of ground which would produce the pretty paper pattern. The town plan is not made primarily to be beautiful, but to provide for the convenient and efficient arrangement of all the different component parts which go to make up the modern city. When the architect is asked to design some decorative feature he is right in concentrating his attention almost exclusively on the creation of a beautiful object; but when he is asked to design a building he must first consider the purposes for which the building is required, its efficiency for these purposes, and its convenience for those who are to occupy it. These considerations will determine the main disposition of the parts, their relation to one another, and the size and detail accommodation required in each; but it is the function of the architect to find a solution of these dispositions, relations, and sizes that will not only give the utmost convenience and efficiency, but in addition will create a beautiful building by the proper adjustment of the different relations, and by the harmonious proportioning of the parts. It is quite possible to create an efficient and convenient building which will be devoid alike of interest and beauty; such a building is not architecture. It is also possible to design a building of considerable superficial beauty of proportion and interest of design which may, nevertheless, be most inefficient for its purpose and inconvenient for its occupants; such a building is equally not architecture in its true sense. It is when the utilitarian objects are efficiently satisfied by a building of beautiful proportions and interesting detail that we have genuine architecture produced.

Exactly the same is true of town planning. In the disposition of the areas, the arrangement and alignment of the roads, the position allotted to the main buildings, the sizes of the different open spaces, and the widths of the highways, the plan may be such as to provide efficiently for the needs of the town, and yet may not contain the elements of design, may lead to no beautiful grouping of the buildings, no distinction resulting from their placing, and no interest arising from the relative position and proportion of the different parts.

It is only when all the utilitarian considerations are fused into some consistent design by the exercise of an imagination specially trained to find beautiful forms by means of which to satisfy useful purposes that a really fine town plan is produced. This is the contribution which the architect, as architect, has to make. A few individual architects may know enough of engineering and surveying to handle the whole problem, just as some engineers and surveyors may have enough architectural feeling to confer that crowning quality of beautiful design on their schemes; but the knowledge required by these different professions, and the cumulative effect of their practice is so different, that usually it will be necessary for a successful result that representatives of the different professions should work together, so that the total contribution of skill may be higher than can ordinarily be expected from an individual who knows a little of each branch. But if this co-operation is to be effective, each party must have sufficient knowledge and appreciation of the importance of the other departments to give due weight to their representations. The engineer must not sacrifice main architectural matters for quite minor considerations of gradient or convenience; nor must the architect sacrifice the utility of roadways by piling them up on embankments in order to maintain some preconceived effect not suitable to the particular problem in hand. In the main it will be found that while the aims and purposes of the architect, the engineer, and the surveyor are different, they are not conflicting; and that a simple, definite scheme with wide, handsome roads and well-designed crossings and road junctions will be the best form in which to provide easy and convenient thoroughfares.

In considering the scheme of

Roads

it is important to remember the two main purposes for which they are required—to accommodate traffic and to afford frontages for buildings. Roads generally serve both these purposes, but their treatment depends largely on the relative importance of the two functions; those that are required to serve as main roadways for traffic should be planned primarily for the convenience of traffic, and their junctions should be considered from this point of view first. On the other hand, those roads, the traffic on which is mainly concerned with the buildings fronting upon them, should be considered primarily from the point of view of affording economical, serviceable, and therefore valuable building frontages. As far as possible such roads should either follow approximately the lines of the contours or should travel at right angles to those lines, so that the plane of the land, in whichever direction it may slope, may be nearly square with the building. Both the satisfactory placing of the building on the ground and the convenient treatment of the garden depend considerably upon this. Not only is the importance of traffic secondary in these roads, but it is even desirable that they should not be planned so as to afford short cuts for main lines of traffic. The only way in which it is possible, without great total cost, to secure adequate width for main arterial roads, is to design the minor roads so that they cannot become trafficways; the actual width of the carriageways and footways in these may then safely be reduced to a minimum, and the saving in land and cost thus effected can be set off against the extra width and cost of the main traffic highways. This does not mean, of course, that the width between the building lines on minor roads should be reduced, nor even that the width dedicated to the roadway should always be reduced. There will be cases in which it may be desirable either to provide space for the decoration of the roadways with grass margins, shrubberies, or trees, or to provide space for possible future widening of footways or carriageways, where, owing to the planning of the roads, an increase of traffic seems possible.

It is hardly necessary to emphasize the degree to which the health and attractiveness of dwelling-houses depend on the planning of the roads. The spacing of the roads influences the frontage given to the houses, and the area of open ground available to provide air, light, and outlook for the windows. Their adjustment to the nature of the slopes of the ground will have a marked effect on the cost of roadway per house; careful planning will preserve the residential roads from through traffic, thus reducing both noise, dust, and danger, and will, moreover, keep open many attractive views of open spaces and distant objects of interest or beauty. The orderly arrangement of the houses themselves and the decoration of the streets with trees and shrubs will add enormously to the pleasantness of the dwellings; and at the same time a good system of main trafficways, by adding to the facility for getting from place to place, will increase the efficiency of the people as industrial workers and add to their opportunities of enjoying social life and culture.

Some sacrifice of the building convenience may wisely be made on arterial roads; in order to increase their directness, or improve their gradients, we shall be justified in carrying out an extent of cutting and filling that would be unpardonable on a building road. Where there is a choice between cutting and filling, it may be taken as a general rule that filling is most objectionable in roads where dwelling-houses are to be erected, and cutting in roads for business premises. Dwelling-houses are much better built above the road than below it. On the other hand, business premises must be entered on a level with the road, and can usually employ a basement storey profitably; this means that when the road is in a cutting, heavy expense must be incurred in excavating the site, and sometimes also in sinking cellars still further below the level. The main consideration on the arterial roads, however, must be the traffic; and it is important to consider this in planning the scheme of minor roads. In order that their traffic should interrupt that on the main roads as little as possible, it should be collected by secondary roads, and delivered by them at not too frequent intervals into the main arteries. It should not be forgotten when planning that every needless junction or crossing on a main artery reduces its efficiency as a traffic carrier. Moreover, when arterial roads are broken into by too many minor roads, the facades of the buildings are apt to become ragged, to lack sufficient breadth and dignity; here as often we find the architectural considerations in harmony with the traffic convenience. On the other hand, in the minor residential roads, the variations which will give further adjustment of the roads to the site, and the limited vistas which will be produced by so planning the roads that, while they divide up the land conveniently, they do not form tempting short cuts, will help the architectural effect with the type of domestic building for which they are intended. The importance of so planning the roads and road junctions as to give at least a favourable opportunity for the beautiful grouping of the buildings must not be overlooked. A straight approach on an axial line to an important building, and the development of the whole of any civic or other centre composed of a group of public buildings on such an axial line, will be found to give a sense of order and dignity. Certain types of building are usually characterized by more handsome architectural treatment; it is desirable that the most should be made of these opportunities, and that these buildings should, as far as possible, be placed where they will confer distinction upon several street pictures, and serve as central features for architectural groupings from several points of view.

In most localities there are features connected with the history of the city's development in commerce, civilization, or culture, around which there cling the most cherished associations of the people, or which keep alive the memory of heroic citizens of the past. Underlying and infusing all the planning which we have been considering from utilitarian and aesthetic points of view, there must be a sympathetic appreciation of these higher elements of the individuality of the city, and an imaginative enthusiasm for their expression in the outward form of the town, if the result is to be a work of art of the higher order.

We must pass now from the town plan to

The Text of the Scheme

Here the architect's point of view is somewhat peculiar. He usually sympathizes with the aims of by-laws and building regulations, but is intensely irritated by their methods; and if town planning schemes are to work smoothly, the municipal authorities must try to understand this point of view.

The architect is delighted that adequate space about his buildings should be secured, but he is annoyed when that space is required to be exactly in one position, and of an exact dimension throughout the width. He would willingly support the municipal authorities if they would ask for two or three times as much average space about the buildings, if only he could be allowed some liberty to dispose this space as may best suit the circumstances of each individual case. He is in full sympathy with the local authorities when they require a certain minimum cubic space to be provided in a living room; but when he is required to reduce the size of a room by cutting off the angles to provide a minimum height to the springing of the ceiling, either wasting the space or providing cupboards that are not wanted, then he is tempted to put in dummy cupboards and remove them after the building is completed.

He is in agreement with the local authority which has sought to prevent the erection of stuffy and congested closes; but when he finds that he cannot erect a quadrangle of buildings without leaving gaps in each angle, or carrying the road right through to avoid a cul-de-sac, then by-laws are apt to become his bugbear, and the defeating of them one of his chief delights!

The town planning scheme is largely an extension of the field which may be covered by building regulations, but it is freed from many of the technical difficulties under which by-laws have been made by the local authorities in the past.

Strictly speaking, there are only comparatively few matters on which, previous to the Town Planning Act, by-laws could legally be made, and much ingenuity has been expended by the local authorities and the Local Government Board to make by-laws produce indirectly effects which they deemed desirable, but which they were not legally empowered to secure directly. One result has been that large sums of money have been wasted in making wide roads, because a by-law could not fix a minimum distance between the houses. There is only one way in which building regulations can be made to work satisfactorily, and that is for them to provide sufficiently generously for the requirements to enable a considerable amount of freedom to be left as to the particular method in which they are satisfied. If you secure a sufficiently ample provision of open space about buildings, you can disregard the exact position in relation to the individual building, and the exact distance at any point across a particular bit of open space. This is a very important consideration when framing regulations under the scheme for limiting the number of houses to the acre. It is in every way wise and practicable to reduce the average number of houses to the acre over a reasonable area to such an extent as will secure not only ample light and air space for the houses, but a sufficient proportion of garden ground in relation to the population to provide quite a considerable addition to the economic basis of the family, and sufficient recreation areas for both children and adults; but if this result is to be attained considerable elasticity must be secured. I find that with an average disposition of ten houses to the acre for a rectangular building plot measuring 10 acres there may be usually sixteen or seventeen houses on 1 acre in the corner. If the space is not rectangular, and should be bounded by roads meeting at an angle of 60 deg., there may be twenty houses to the acre on the corner; or, if the road should meet at a still more acute angle—say, 45 deg.—the number of houses to the acre may go up to twenty-four or twenty-five if the full use is made of the road frontage, and all the houses are of the smallest type. While, therefore, over the whole unit of 10 acres it is desirable to reduce the number to ten, twelve or fifteen to the acre, very great care must be taken not to cause a needless waste of road frontage at junctions by insisting on too low a maximum of houses on the individual acre, or on too arbitrary a method of measuring it. It will be seen that, if the acre at the corners were measured to include more of the back land instead of being made square, the lower maximum number of houses on the individual acre would be practicable without causing waste of road frontage. For this reason I think it is a good rule that the general limitation should be sufficiently drastic to secure plenty of open space, but that the particular limitation applying to the individual acre should be sufficiently generous not to cause unnecessary waste of road frontage. Further, if open space is secured generally by the limitation of the number of houses to the acre, any requirement as to the area of open space at the back of the building, or as to the proportion of an individual plot which may be covered by buildings, should leave the greatest possible elasticity in the laying out of buildings around corners.

It is not generally realized how difficult it is to stereotype the minor development of a plan for a large area without causing very serious waste. For example, if a town planner were to lay out the detail roads on 20 acres of land on a basis of ten houses to the acre, under the expectation that the average frontage per house would be 30 ft., he would have to secure a certain depth of plot and distance between his roads and provide 2,000 yds. of road frontage; but should the type of house eventually built be a narrow house having an actual building frontage of only 15 ft. or 16 ft., probably the average frontage of road required would not much exceed 20 ft.; but he would have laid out 666 yds. of frontage, or 333 yds. of roadway on these 20 acres more than was required, and the unfortunate person who had to develop the land would have wasted £1,333 if the roadway cost £4 per lineal yard. Now it is not possible to foresee exactly what type of house will be built in different places, and therefore elasticity in the number of minor roads, their arrangement and placing on a plan must be permitted if waste is to be avoided. On this account I am inclined to think that the best arrangement for limiting the

Number of Houses to the Acre

is to fix units of reasonable size, taking, as far as possible, areas that are defined on the town plan by main roads, railways, streams, or other definite features not likely to be changed. There should, then, in connection with each unit, be fixed a maximum average density for the whole of the unit, and a maximum density for any one acre within the unit.

But there is still one point to consider: Houses vary very much in size. If it is permissible to have a certain maximum number of large houses on an acre of land, is it not permissible to have a greater number if the houses are each only of one-half or two-thirds the size? In deciding this matter, we must consider the reasons for limiting the number of houses to the acre. These are mainly two: First, limitation aims at providing a sufficiency of open space about dwelling houses to secure an ample supply of the freshest of fresh air and full access for sunlight, both of which are necessary for health. So far, then, as this reason goes, it would seem to be important to take into account the size of the building in fixing the number to the acre, otherwise the larger the building the less would be the open space. There is, however, a second reason for limiting the number of houses—viz., to secure, on the average, to each family the use of a certain amount of ground for recreation, for the growth of garden produce (a matter of great economic importance), and for the preservation of the pleasantness, or, as it is called in the Act, "the amenity," of the area. For this purpose the amount of land required is rather a fixed quantity per family, and does not necessarily depend on the size of the house. The family living in the small house really needs as much land as the family living in the larger house; but it can hardly be contended that it needs more. So even here there is reason for making some difference, because with a given number of houses to the acre a small house, owing to the less area which it covers, will be left with a larger area for garden than the large house, and the utmost that can be said under this heading is that as much land is needed.

There is, however, another pressing reason for doing something to adjust the area of land to the size of the house, and this is the increasing ratio which the cost of the site bears to the cost of the house as that cost decreases. In a house costing £1,500, the cost of the site, including the cost of road making, will usually be no more than one-sixth of the value of the house; in the case of the £150 cottage, the value of the site will not uncommonly be found to represent one-quarter or even one-third of the value of the house. This means that, relatively, the smaller the house the greater is the expense of providing it with a site. If, then, we fix a given limit to the number of houses without reference to their size, we shall add still more to the relatively higher cost of site for smaller dwellings. This is not desirable, for already there is a strong inducement to the builder to build on each plot as big a house as possible, because the bigger house will carry a little more ground rent or site value than a small one, even for the same actual area of ground.

For all these reasons, therefore, it seems to me of importance that the number of houses to the acre should be limited by means of a schedule, which should fix the number in relation to the size of the house, and for the purpose of determining the size of the house one needs to take the effective size, and to eliminate accidental matters, such as the difference between a high-pitched roof or a low-pitched roof, or the difference between a house that has a large cubic space occupied by foundations and one that has a minimum of foundations. On the whole, therefore, I think the best plan is to fix the number according to the cubic contents of the building, measured to the outside of external walls, to the centre of party walls, and excluding from the measurements all unused space above the level of the highest ceilings and below the level of the ground floor of the building. The schedule would then be somewhat as follows, the actual numbers being adapted to suit the individual circumstances:—

Houses containing not more cubic ft. than	Maximum average to the acre	Maximum on any one acre
5,000	15	20
6,300	14	19
8,000	13	18
10,000	12	16
12,000	10	14
14,000 and over	8	12

The question of

The Building Line

in town planning schemes has considerable bearing upon the building of houses and the architectural effect of the streets, and it is not easy to frame regulations that will work satisfactorily in all cases. There are existing roads on which it may be desirable to fix a building line for the purpose of securing the possibility of road widening at some future date should the traffic on the road develop sufficiently to require it. A line that is fixed for this purpose must, if it is to be effective, apply to all buildings, and must not be subject to exceptions on corner sites, or for the purpose of giving a sense of enclosure to the street view at certain points. On the majority of roads that are mainly used for building purposes, and have only to accommodate local traffic, and on new roads laid out of ample width, the question of street widening beyond the limits of the street boundaries hardly arises. Here the building line is fixed for the purpose of providing adequate width between the rows of houses to secure light and air, and the amenity of the streets; for this last purpose it is desirable that there shall be some opportunity for varying the building line. In some schemes the minimum amount of set-back which could be accepted for any building is all that has been secured, leaving anything further entirely to the option of the builder; in other schemes an attempt has been made to secure a more generous depth of forecourt over the general frontage of the street, but at the same time to give opportunities both to bring forward certain limited lengths of frontage here and there, and also to bring forward, to some extent, the houses at the corner of two streets, so that the amount of road making which must be wasted at street corners may not be unduly increased. While it is certainly desirable in town planning schemes that there should be an opportunity for a settled building line more interesting than the simple continuous street line, it is obviously not desirable that houses should be dotted down along the road irregularly, just where each individual builder may think fit. For this reason, perhaps, the best solution of the building line difficulty is to require a minimum length of building frontage to be submitted as a definite scheme where the ordinary building line is to be departed from. Clauses to this effect are provided for in the Ruislip scheme.

Where the land slopes steeply it is not at all desirable that the buildings on each side should have to be an equal distance from the centre of the road; generally speaking, and where land in several ownerships has to be dealt with, the building lines may need to be set out equidistant from the centre of the road; but provision should be made in the scheme for cases where it is desirable that houses should be set much nearer the road on one side, generally where the ground is falling from the road. This may be compensated for by setting back the houses on the higher side of the road, the distance between the two building lines remaining the same.

Having secured ample space about buildings, perhaps the next most important point is to secure that adequate

Frontage

shall be provided for each house, and that long projecting wings shall not be permitted in such a way as to block proper access of light and air to the windows. There is in the Ruislip scheme a somewhat complicated clause dealing with this matter which secures an angle of light of 45 deg., but it does not prevent the window to a living room being placed at the end of a narrow space between two wings. A simple regulation requiring that all the living room windows should have a certain angle of light vertically and horizontally would, I think, be more effective, and more readily secure the desired result; such angles should not be less than 60 deg. This would allow of reasonable projections to buildings, but would prevent their undue extension in length, or their undue proximity to each other in the manner that is so objectionable in a very large number of buildings erected under the ordinary by-laws.

Where an attempt is made in a town planning scheme to fix the height of buildings, or to limit the number of storeys, care must be taken that this is not effected in such a rigid manner as to require on a sloping road the stepping down of every building. Provision should be made that a level roof may be carried over a group of four or six buildings, and the extra height of the lower buildings utilized for an additional storey.

In a similar way, one might go through many other individual regulations which aim at something which is desirable, and might point out how easily, if these regulations are looked at apart from the point of view of those who have to build under them, they may prevent many things which are quite harmless from being done, and may even entail the doing of much that is undesirable. For this reason it is most important in framing town planning schemes that the local authorities should enlist the co-operation and assistance of architects and builders. It is perhaps natural that the busy official of a local authority who is trying to put through a town planning scheme in the short spaces of time he can snatch from his other work should be somewhat impatient of criticism and suggestions; but he should remember that he looks at a regulation purely from one point of view, and that no regulation is good which only satisfies the point of view of the official. The Town Planning Act is so framed that any new regulation that is included in the scheme can be carefully adjusted to meet the

Needs of Exceptional Cases,

and to suit the varying circumstances of different districts, and even different areas within the same district. The framing of such regulations is by no means easy, because it is not only the effect of the particular regulation that has to be considered, but the constructive effect of two or three regulations taken together. For example, in the draft of one scheme it was provided that on certain roads houses should be set back 35 ft. from the boundary of the road, and it was also provided in another part of the scheme that no house in a certain area should be more than two storeys in height. Where land was sloping steeply, the result of setting back the houses 35 ft. would be that one storey would be below the road, and would be in effect a cellar; so that these two regulations, taken together, would mean that on certain sites houses could only be built having cellars and bedrooms, with no proper ground floor rooms at all. What we need is so to frame our regulations that they will effectively prevent anything that is detrimental to health or injurious to the amenites of the district, but will leave the utmost possible freedom for every builder to do anything that he may desire to do that is in itself harmless and unobjectionable.

So far we have been considering the regulations of a town planning scheme as affecting the placing of buildings and the distribution of space about them; but the town planning scheme affords an

Opportunity for Modifying By-laws

in England, or regulations made under the Burgh Police Acts in Scotland, and these are much needed. In England the by-laws were framed especially to prevent the evils springing from an overcrowded development of small houses packed together in long rows, without proper access, air space, or sanitary conditions. Such packing together of small houses produced certain dangers which had to be met by a fairly complex system of building regulations, aiming to secure protection from fire risks, sanitary conditions, and a certain standard of stability; but if once the overcrowding of these dwellings is prevented by a definite limitation of the number of buildings which may be placed upon an acre of ground, the whole character of development is changed; the relative importance of many matters must necessarily change also. For example, with endless rows of dwellings packed together closely, the risk of fire spreading from house to house over a large area may be sufficient to justify the by-law requiring parapet walls to be carried up through the roof between each pair of houses; but with the development which follows from the limitations of houses to the acre, such risk is greatly reduced, and the requirement ceases to be one on which it is desirable that the local authorities should insist, for not only can the cost of complying with it be spent to much greater advantage in other ways on the building, but it is in itself an ugly and inconvenient expedient, only justified by a very serious danger.

In Scotland the Burgh Police Acts have been largely framed with a view to meeting the difficulties arising from the prevalence of many-storied tenement dwellings. With a limitation of the number of dwellings on the acre, there can be no doubt that this system of housing families one above the other will give place to that of housing them each in their own house, standing on its own plot. It is necessary, therefore, that all the regulations embodied in the Burgh Police Act, or enforced by Dean of Guild Courts, should be reviewed in the light of the new conditions set up by the Town Planning Act. For example, where population on the acre is as dense as it usually is with many-storied tenement houses development, certain expedients have been adopted to try to secure a modicum of fresh air for each person. Among these, the heights of rooms have been fixed much greater than is commonly adopted where cottage dwellings are built. It may or may not be some slight advantage for comparatively small cottage rooms to be 9 ft. or 10 ft. high; opinions widely differ as to whether any height above 8 ft. is really of advantage in such rooms; but it is hardly open to doubt that it would be a much greater advantage to secure an extra foot in the size of the room, and, further, that additional height over 8 ft. when all the rooms have windows looking out upon ample open space is, to put it at the highest, such a very small advantage that the local authority is not justified in compelling it. The cost had much better be spent in making the rooms a little larger, and under the town planning scheme, which allows rooms to be 8 ft. high, a provision requiring a minimum floor space or a minimum cubic space, or both, can be inserted. The two-storey cottage also does not need such a heavy form of construction. Questions of climate must, of course, be considered, but there is no reason to suppose that an 11-in. hollow wall would not be as weather-proof in Scotland as it is found to be in all parts of England; and it is doubtful whether in walls having one air cavity there is any necessity to strap the inside of the wall under the plaster to form a second cavity. Exactly what modifications in detail should be made, and how far differences of climate would affect these, as compared with the modifications found desirable in England, can only be determined after careful consideration of the new conditions by those having a knowledge of both systems of development. I wish only to emphasize the point that a local authority should not attempt to secure in connection with the dwelling the utmost in every direction that the particular surveyor may think desirable, but that they should secure the main conditions necessary for health, and should then leave to the individual builder some freedom to develop in one direction or another as may seem desirable for different classes of tenants.

Above all, let it not be supposed that housing reformers are asking for by-laws to be relaxed; nothing could be further from the truth. In asking for a limitation of the number of families which should be allowed on the average to occupy an acre of ground, housing reformers are calling for a far more drastic regulation than anything which has ever been proposed, one which so alters the character of development that it renders many old regulations no longer necessary, and what they seek is that certain minor requirements chiefly applicable to the older types of development, which are found to hamper the newer and better system, should be removed or adapted to the new conditions.

Certain other regulations should be considered also in reference to the introduction of

New Building Materials,

notably in regard to concrete and reinforced concrete, for both of which there is undoubtedly a future as building materials for dwellings in those districts where suitable aggregates are plentiful, and where the more ordinary building materials, brick and stone, are not so easily obtained.

The Town Planning Act gives power to control the character of buildings, and this would seem to carry with it the right to exercise some supervision over the general character of their designs and the materials of which they are composed, with a view to preserving or securing the amenites of the scheme. Such power has been exercised in the past by enlightened ground landlords in developing their estates, but has not been given to local authorities. It is admittedly a matter of some difficulty, because design or character cannot be defined in precise terms of a number of measurement, and, moreover, is subject to a certain variation of individual taste and opinion; but, none the less, I believe that some such control is desirable, and that the difficulties are less than appear. It is true that if you asked a dozen architects to design a building to fit a certain position, you would receive probably a dozen different designs; but, on the other hand, if you submitted any design for a building to a dozen architects, you would probably get an almost unanimous opinion as to whether that design was such as could reasonably be allowed to be erected in the particular place. There would be a general consensus of opinion which would rule out all designs below a certain quality, although of the designs above that quality there might be some difference as to which should be placed first. Now, in the regulation of design by a local authority, what is aimed at is not to secure absolutely the best among the many good designs, but to maintain a certain average standard, to preserve streets from being spoilt by the erection of buildings which are monstrosities of ugliness or bad taste. This I believe to be both practicable and desirable; but it is work that should not be attempted by a committee of laymen. The layman will very often know what he likes, and what he does not like, and his taste may be good, but he cannot tell what it is that causes him to like a building, and does not understand how a design fails or how it can be amended. Only the trained architect is qualified to exercise this function, and where the local authority desires to criticise the general character or design of buildings, it is at least due to those submitting plans that the criticism should be only entrusted to a well qualified architect, of such standing and independent position that he is not likely to be influenced by petty considerations.

What the municipal authority can do for architecture by means of a town planning scheme, and by the control of buildings, is not to secure fine architecture, but to grant an opportunity for its development, to prepare an adequate stage for its display, and to protect such fine architecture as may arise, and as I believe will arise, out of these better conditions from being spoiled by incongruous surroundings and the ugly freaks of eccentric fancy.

If by means of co-operation between the architectural profession and the municipal engineer a mutual understanding of this position can be secured, a very great step will have been taken towards the building up of more beautiful cities in this century than those which have resulted from the activities of the last.

System, as Applied to the Engineering Department

Specially contributed by J. L. Busfield, B. Sc., A.M. Inst. C.E., A.M. Can. Soc. C.E.

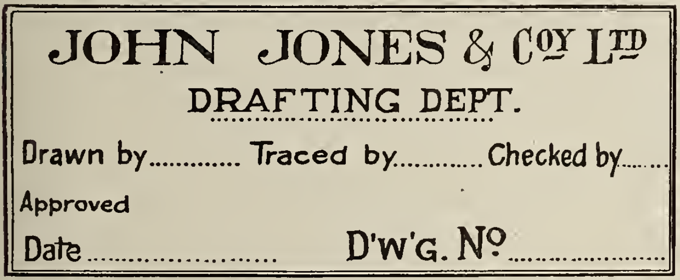
THE trend of modern conditions is to a higher efficiency in all walks of life, no matter whether it be in connection with the operation of a commercial enterprise or in the actual process of living. In the case of a commercial enterprise everything possible is done to counteract the increasing costs of human labor, raw material, etc., by insuring as high an efficiency of production as can be obtained. This applies not only to factories and constructional work but also to office forces. As an illustration it is only necessary to visit any large business office and view the many contrivances in use—from complicated calculating machines to small machines for sticking stamps on envelopes. At the same time highly scientific methods of accounting and bookkeeping are in use, not to mention the modern card indexes and filing systems. The use of these machines and methods has a very marked financial result, either by a reduction of office forces or by an increased production of the existing force.

The engineer or contractor is just as much concerned with this high efficiency of production as the commercial man, and all manner of appliances and constructional methods have been placed at his disposal to facilitate his work. The use of such appliances and methods is usually accompanied by a benefit which can be measured in dollars and cents, but the question arises: does the engineer carry efficiency into the details of his own office or engineering department where a direct financial return is not so apparent? When an engineer opens up an office, whether for himself or as a corporation employee, he will frequently—perhaps from motives of economy—omit to apply much system to his office and field work, but will make some plans and place them away in a cupboard relying on his memory or that of some assistant to produce them when required. Similarly with field notes and calculations, the former are no doubt taken in proper field books, but when filled the books are deposited in some drawer and allowed to accumulate indefinitely. Not infrequently they are made on scrap paper and when completed deposited in the wastepaper basket. These methods may work quite satisfactorily to start with, but as the business increases, and as time goes on, the plans and notes accumulate, and one's memory is not so reliable. Perhaps, also, an assistant with valuable knowledge of the whereabouts of plans and notes leaves the office, with the result that when some particular plan is required it has to be searched for among many others or cannot be found at all. When an office is first opened there may only be a few plans, etc., and with no definite knowledge of future requirements it is hard to determine on any proper system of filing and recording them. It is easy for the engineer to defer this matter until his business grows and he becomes too busy to devote his time to office system.

There are quite a number of different methods of filing and recording plans in general use. Perhaps the oldest and simplest is to roll up all the plans and place them in pigeon-holes or drawers. The disadvantage of this method is that small plans get pushed to the back of the pigeon-holes and become hidden and crumpled; and a small plan which has been kept rolled up becomes inconvenient to handle. It is now customary in all the larger engineering offices to file all the smaller plans flat in drawers, and to roll all the larger ones (say, over 48-ins. long) and file them either in pigeon-holes or drawers as found most convenient. Pigeon-holes are preferable, because a drawer large enough to accommodate the widest plans, i.e., about 42 ins., becomes awkward to handle. In cases where there are only a few large plans dealt with, it is sometimes quite satisfactory to fold them and keep them flat, but it cannot be recommended as good practice ever to fold a tracing. There are a great variety of drawers and cabinets for filing plans on the market, and it is unnecessary to describe them. In many cases a handy carpenter can knock together a suitable cabinet at very little expense. The drawers should be divided into compartments of different size, so as to avoid losing a small plan between two larger ones.

It is advisable to adopt certain standard sizes such as 18 ins., 24 ins., 36 ins., and 48 ins. in length, with two or three alternative widths for each size. It may be claimed that keeping to a standard size may lead to an unnecessary waste of tracing linen, but this is rarely so if the draftsman lays out his drawing with the foreknowledge that it has to fit one of the standard sizes. All plans should then be numbered according to their size, i.e., all plans 24 ins. long should have the prefix 24 in front of the serial number so that the only place to file plans with the prefix 24 would be in the compartment for 24-in. plans. The plans in each compartment should then be kept in numerical sequence, so that there could only be one correct place for filing any particular plan. For the long plans to be rolled and filed in pigeon-holes the prefix "R" might be used. Not only should all the plans conform to the standard sizes but when a number of plans are being made of one machine, building, etc., all should be kept to one size as far as possible without excessive waste of linen, so that when all the plans are completed they may be bound into a set (either tracings or blueprints), this being very convenient for reference. If a set of blueprints is made up in this way and kept in the office, it will frequently save a great deal of wear and tear on the original tracings. Wherever possible the filing cabinet should be kept in a fireproof vault. If the plans are at all numerous or valuable, the expense of building a small vault would be insignificant compared with that of replacing the plans, many of which it might be impossible to reproduce at all.

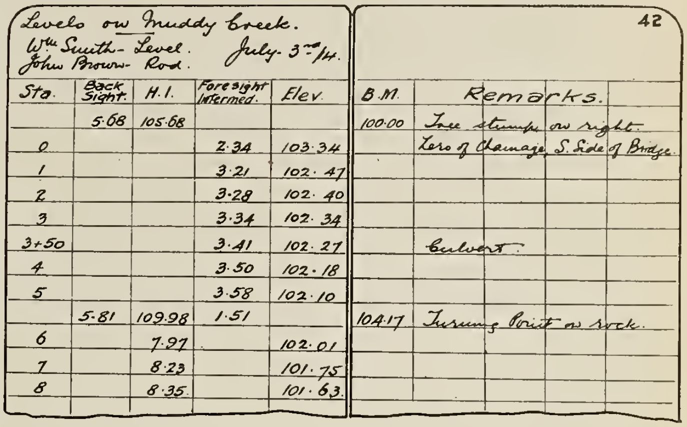
Having provided a suitable place for filing the plans in numerical order, it is necessary to have some ready method of obtaining the number of any particular plan. With regard to numbering plans, it is very convenient to have a rubber stamp made somewhat on the lines shown in Fig. 1. Such a stamp can be obtained very cheaply and if used in conjunction with a special black ink a very clear impression can be obtained both on a tracing and on blueprints made from the tracing. A "cache" of this kind, besides its usefulness in giving a record of the draftsman and drawing number, also gives a neat, finished appearance to the plan. Some engineers prefer to have the stamp made large enough to include the title, but this is a detail which may be left to individual taste. The indexing of the plan numbers requires considerable attention in order to meet with all the requirements and practically has to be studied for each different office, but there are some methods which will suit almost all conditions.



JOHN JONES & CO

Fig. 1.

The first and simplest way is to have a book for the especial purpose of recording plan numbers. This book can be divided into sections for the different sized plans, the numbers being kept consecutive in each section. In a book for this purpose columns should be provided for the drawing No., date, name of draftsman, title, scale, and any remarks. As a basis for a complete index, a book of this form is both useful and necessary, but it is incomplete in itself, because, in order to find the number of any plan it might be necessary to search through all the different sections of the book, unless the size and date of the drawing were remembered. To make the system complete a classified index is required as an adjunct to the numerical index. This may be kept in another book, but the simplest and most convenient way is a card index. It is quite cheap to have cards prepared (costing about $2.00 a thousand) so that for every plan a corresponding card is filled in and placed in the classified index. The way the index itself is divided will naturally depend on the nature of the work performed in the office, but in all cases it should be so divided that no one section contains more than 30 or 35 cards. Main divisions, such as mechanical, structural, civil, should be made and each should be sub-divided into a number of smaller divisions for each distinct piece of work, or kind of plan. It is very frequently arranged that when the cards are made up they are written in duplicate on a typewriter so that two separate and identical indexes can be kept, one, say in the drawing office, and the other in the Chief Engineer's office. In some cases instead of having two identical indexes, it is desirable to have two classified differently, one, say, by the nature of the work, and the other by locality. In fact there are offices with no less than three separate indexes for plans; but two, used in conjunction with the plan record book will usually be found ample for all requirements.



Levels on Muddy Creek.
Wm Smith - Level.
John Brown - Rod. July. 3rd/14.

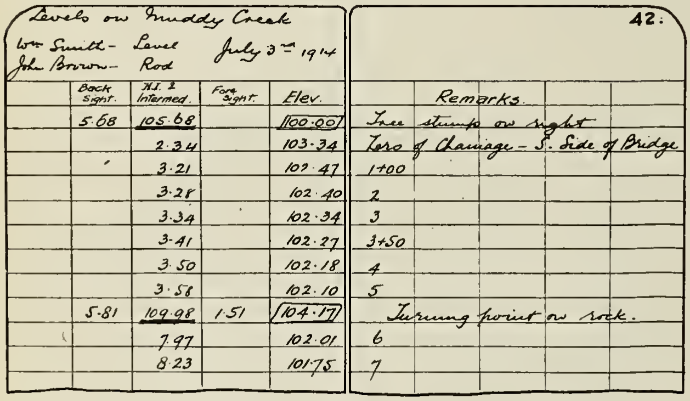
42

Sta.	Back Sight.	H.I.	Foresight Intermed.	Elev.	B.M.	Remarks.
	5.68	105.68			100.00	Tree stump on right.
0			2.34	103.34		Zero of Chainage, S. Side of Bridge.
1			3.21	102.47		
2			3.28	102.40		
3			3.34	102.34		
3+50			3.41	102.27		Culvert.
4			3.50	102.18		
5			3.58	102.10		
	5.81	109.98	1.51		104.17	Turning Point on rock.
6		7.97		102.01		
7		8.23		101.75		
8		8.35		101.63		

Fig. 2.

In an office where half a dozen or more draftsmen are employed, it is frequently an economy to engage an intelligent boy of 16 or so who can file all plans, and at the same time do odd jobs around the office. If a blueprint machine is kept he can make blueprints. Such a boy can keep the plan records, with a little supervision from the chief draftsman, but if it is not considered expedient to have a boy, the junior draftsman should be made responsible for the proper indexing and filing of plans. A system in use in an office which keeps a blueprint boy (and which works very satisfactorily) is for each draftsman on completion of a plan to write on a slip of paper, the title of the plan, with full particulars of size, date, scale, etc. The boy enters these particulars in the plan record book opposite the first vacant number for the size of plan in question, gives this number to the draftsman, and also writes it on the slip, which he retains. From time to time (say, once a week) these slips are given to the stenographer who types the particulars on to the index cards in duplicate or triplicate. The cards should then be placed in their respective sections by the chief draftsman or someone else thoroughly familiar with all the branches of the work.

In many offices it is customary to file plans, without using numbers at all, by keeping all those referring to one locality or piece of work in one compartment. This works quite satisfactorily provided the number of plans is small, but as soon as they begin to accumulate much time is apt to be lost in hunting for plans, and the expense and time involved in changing the system becomes very great. Whatever system is adopted it should always be made with a view to future expansion. Care must also be taken in filing the plans in the correct places, otherwise mistakes will occur, and a misplaced plan can cause no end of confusion. In a concern where there are a number of different compartments which are liable to use the plans, it is desirable to permit only one person to remove plans from the files, and he should keep a complete record of every plan removed and returned. The time involved in this operation is very small and will be amply repaid in the elimination of a great deal of trouble through mislaid plans. At the same time the chief draftsman or engineer-in-charge of the drafting department should keep a complete record of all blueprints given out to all other departments. This can be done either by keeping a book for the purpose or else by sending a memorandum with the prints and keeping the carbon copy on file.



Levels on Muddy Creek
Wm Smith – Level July 3rd 1914
John Brown – Rod
42:

	Back Sight.	H.I. & Intermed.	Fore Sight.	Elev.	Remarks.
	5·68	105·68		100·00	Tree stump on right
		2·34		103·34	Zero of Chainage – S. Side of Bridge
		3·21		102·47	1+00
		3·28		102·40	2
		3·34		102·34	3
		3·41		102·27	3+50
		3·50		102·18	4
		3·58		102·10	5
	5·81	109·98	1·51	104·17	Turning point on rock.
		7·97		102·01	6
		8·23		101·75	7

Fig. 3.

Every draftsman or designer who does any calculating work should be provided with a book kept solely for this purpose. This book should be titled and indexed, however insignificant the work may appear at the time. Not only the draftsmen, but also the field men who have occasion to make computations in the office, should follow this rule.

With regard to the notes of the field men, it should always be insisted upon that every man taking notes, on however small a piece of work, should give full particulars (on the top of the first page) of the nature of the work, the date, names of men engaged in the work (with the position of each), and any other information pertinent to the work. If the survey is large enough to fill a number of pages of the notebook, this information should be repeated from time to time. It is surprising how frequently a transitman will omit to give any particulars of this nature in his notes, perhaps expecting to plot them and always refer to them himself, or intending to do so in the office. The importance of proper titling, etc., whether in connection with the field or office work cannot be impressed too strongly on the forces. A few minutes devoted to this may save hours of time and labour in the future. The actual method of taking notes requires careful attention, and too much care cannot be taken to insure that they will be equally as intelligent to a man in the office as to the man who makes them. It is unnecessary to give details here of taking notes, as this is discussed in all standard works on surveying. Every individual has methods of his own to suit his particular needs.

The form in which levels are taken differs very much with different men, but it is natural that the simplest form which will facilitate the mathematics, and also the reading of the notes for the final plotting, should be recommended. The form regularly shown in most text-books on this subject is shown in Fig. 2; and is no doubt used extensively with satisfactory results, but an examination of this form shows certain points which do not seem to conform with the requirements. For example, the information which is required as the final result of the levelling, that is, the stationing, the elevations, and the remarks are all separated about as widely apart as possible, whereas it seems more natural that these items should be kept adjacent. It is far easier to plot the notes from adjacent columns, and just as simple in making the notes. Again, taking the mathematical part, most men find it far easier to subtract figures placed vertically under one another, and as the Height of Instrument occurs only occasionally compared to the intermediate and fore-sights, it is surely simpler to place all these in one column, so that the subtractions can be made readily. The form of notes shown in Fig. 3 fulfils these requirements and is far simpler to make and easier to read in the office. Bench mark elevations can be identified from profile elevations by means of a circle. The levelman should also be encouraged to reduce his levels as he proceeds. There is usually time to do this while the rodman changes his position, and the reduction of the levels at the spot where they are taken frequently leads to a detection of a small error which might be overlooked otherwise.

When the field notes are turned in to the office, each book should be numbered and completely indexed, and a separate book should be kept as an index for all the books. A cabinet or drawer should be reserved specially for filing the notebooks so that ready reference may be made at any time to the original measurements of any piece of work.

In addition to the systematic and methodical arranging of plans, notes, etc., it is equally important that the work of the different men should be properly organized, but the conditions controlling this organization of work vary so that it is beyond the scope of these notes to deal with it. The financial value to the engineer or company of applying systematic methods to the engineering department, as outlined above, may be difficult to establish in dollars and cents, but there is no doubt that real benefits accrue, not only financially, but also in smoothness of working, and in elimination of small worries, such as a mislaid plan, or the duplication of work already performed.

The total quantity of Canadian Portland cement sold in 1912 was 7,132,732 barrels (1,248,228 tons), as compared with 5,692,915 barrels (996,260 tons) in 1911, an increase of 1,439,817 barrels or over 25 per cent. The total consumption of Portland cement in 1912, including Canadian and imported cement, was 8,567,145 barrels of 350 lbs. net each, as compared with 6,354,831 barrels in the previous year, being an increase of 2,212,314 or nearly 35 per cent, according to statistics issued recently from the Department of Mines.

Design, Test, and Cost Data on New Municipal Refuse Incinerator at Regina

In the early part of 1907 the City Commission of Regina, Saskatchewan, decided to erect an incinerating plant to care for the refuse of their city. The contract was let to the Decarie Incinerator Company of Minneapolis, Minn., and a 50-ton, single-unit plant of the steel water-jacketed type was installed at that time. The incinerating furnace proper was constructed entirely of steel 10 ft. square by 12 ft. 6 ins. high, inside dimensions, with a 4-in. water space on all four sides and with a 2-ft. steam and water space above the crown sheet. Along two sides of the furnace were placed 1½-in. extra heavy pipes connected to the crown sheet at the top and to the firebox sheets at the bottom. The pipes were spaced at 9-in. centres and bent so as to form a basket grate to receive the refuse which was charged in from the wagons on the floor above through four 3-ft. square hopper openings in the crown sheet. By this means the refuse was suspended in an indestructible grate about 3 ft. above the lower or cast-iron shaking grates on which the material was finally consumed, giving the fire free access to all parts of the newly charged material without in any way obstructing the draft, or deadening the fire below.

This one 50-ton unit was installed in a brick building with wooden driveways to the upper floor, enabling the refuse wagons to come in on the floor above and deposit their loads directly into the furnace. Nothing but natural draft was provided and that was furnished by a steel stack 135 ft. high by 4 ft. diameter at the top.

At that time it was thought that a plant of 50 tons daily capacity would be amply large for several years to come; but Regina has shown a phenomenal growth during the past few years and late in 1912 it was plainly seen that in a few months the plant would need to have additional capacity. Consequently, steps were immediately taken by the city commissioners to outline a larger refuse disposal system for the city and one of sufficient size to care for future requirements. The city already had under construction additions to their 2,500,000-gal. sewage disposal plant which is located in the extreme northwestern portion of the city. The pumps to be installed here were to be electrically operated, and immediately the question arose as to the advisability of utilizing the heat generated by the burning refuse to help furnish the power for operating these pumps. It was known that the heat from a city's refuse is converted into electrical energy in many European cities and used to produce a source of revenue. It was also known that the incinerating plant built by the Decarie Incinerator Company, at Minneapolis, had for years been furnishing the power to light several wards of the city, and, consequently, it was decided to investigate the feasibility of such an arrangement in connection with the sewage plant.

Owing to the satisfactory results obtained by the original incinerator it was decided to let the Decarie Company make the city a proposition on a plant of larger capacity installed at the sewage disposal works with means provided for converting the heat generated into electrical power. The company agreed to construct a modern plant at the site of the sewage disposal works for the sum of $64,000, the plant to consist of a new 60-ton unit and the old 50-ton unit renovated and moved into the same building with the new one, making in all a plant with a guaranteed capacity of 110 tons in 24 hours. The plant also was to be equipped with two 100 h.p. Babcock and Wilcox water tube boilers, together with forced and induced mechanical draft.

In May, 1913, the contract was awarded to the Decarie Incinerator Company at the above figure. On December 1 the new plant commenced operation. The essential terms of the proposal as furnished by the contractors to the city were as follows:

Contractor's Guarantee

The new unit to be installed should have a capacity of incinerating 60 tons of refuse in 24 hours and the old unit after being remodelled and installed in the new plant should have a capacity of incinerating 50 tons of refuse in 24 hours. The refuse was understood to consist of kitchen garbage, combustible material, manure, and dead animals mixed together in proportions as created by the city of Regina from day to day, no attention being paid as to the selection of any particular kind of refuse or garbage. It was understood that manure would constitute 60 per cent of the refuse to be destroyed, all material delivered to the incinerator to be destroyed without creating any noxious odors or gases.

The total cost of operation was not to exceed 65 cts. per ton and if credit were given for power developed by the boilers, at the rate of 70 cts. per 1,000 lbs. of steam, the cost to be reduced by one-half, and if 30 per cent of the total refuse proved to be dry combustible the addition of fuel would be unnecessary.

It will be noted that the guaranteed cost of operation is somewhat higher than this firm usually guarantees. This was due to the large percentage of manure that had to be handled. However, as will be noted from the results of the final tests here given, this was a safe guarantee as the operating cost came to only 40 cts. per ton when burning 60 per cent of manure. The old plant had a guaranteed cost of 50 cts. per ton and operated at an average of 30 cts. per ton for the five previous years. The old plant handled no such percentage of manure as the new plant was required to handle. In fact in the old plant the city had difficulty in consuming the manure without additional fuel, as this plant was equipped with no mechanical draft whatever.

Design of Plant

The new plant is located on the bank of Wascana Creek, building being of concrete, brick and steel construction 44 ft. by 54 ft. inside dimensions. Two sides of the first floor of the building were formed by the concrete retaining walls. The remainder of the building walls are of brick. The hopper or charging floor is of reinforced concrete supported on steel beams. The standard gage steel car track, on which the refuse is delivered to the plant in special dump-cars, passes through the building at the hopper floor level.

The roof is of 3-in. concrete slab construction covered with tar and gravel roofing supported on steel purlins and trusses. I-beam trolley tracks are attached to the under side of the trusses over each unit, on which chain blocks operate to raise the heavy cast iron hopper covers and also the carcasses that are brought to the plant for destruction.

All material as it is delivered to the plant is dumped directly into the furnaces from the cars, without storage of the refuse being necessary. Drain connections to the sewer as well as water and steam connections are provided on the charging floor for keeping the cars and the floor in a sanitary condition. The incinerating furnaces and boilers, together with all the other necessary machinery, are located on the lower or operating floor.

The two separate units are of 60 and 50 tons capacity as stated above. Each unit consists of an incinerator, combustion chamber and one 100 h.p. Babcock & Wilcox boiler. A pre-heater or regenerator for heating the forced draft fan, direct connected to the chimney. An American Blower Company's induced draft fan, direct connected to a 11-in. x 8-in. automatic high speed self-oiling steam engine, is provided, as well as an American forced draft fan, direct connected to a 9-in. x 7-in. steam engine of similar construction. Four 5½ x 3½ x 6-in. March feed pumps are provided; one for each incinerator and one for each boiler.

The chimney is 5 ft. diameter at the top and 125 ft. high, of radial brick construction with octagonal, common brick, base set on a heavy concrete foundation just outside the building wall.

As can be noted from the illustrations the new incinerator is made with larger and narrower dimensions than the old unit; being 6 ft. wide by 18 ft. long by 10 ft. high, inside dimensions. It has 4-in. water legs and a 2-ft. steam and water space above the crown sheet. With these proportions the labor necessary for stoking is materially reduced, and as the number of stoking doors is much smaller, not nearly as much cold air is drawn into the furnace.

The longitudinal header, connecting the two end water spaces and into which all the 2-in. basket pipes are connected at their lower ends, is made of 12-in. extra heavy pipe in the new incinerator and 8-in. extra heavy pipe in the old one. As will also be noted from the sectional illustrations the pipes forming the basket grate do not connect into the inside plates but come through the water leg and by means of union tees and elbows connect into the outside sheets. This arrangement enables these pipes to be kept thoroughly clean by means of plugs located in the tees.

Operation of Plant

The refuse enters from the upper floor through the balanced doors in the brick lined hoppers and drops into the basket grate. As it burns in this position, and on the shaking grates directly beneath, the gases pass into each respective brick-lined, steel-cased combustion chamber where they are thoroughly mixed and burned before entering the boilers through the side wall directly over the boiler grates. The gases then pass around the water tubes of the boiler giving up a large amount of their heat to the generation of steam in these tubes. It will be noted that by this arrangement the boilers can be operated simultaneously with the waste gases and with coal in case the heat from the refuse is not sufficient to maintain a constant pressure. This condition is likely to occur in wet weather or when the heat value of the refuse is exceptionally low.

After leaving the boilers the gases pass under the floor and up through the pre-heater, or generator, direct to the chimney; or they may be drawn through the induced draft fan in the chimney as the conditions may require.

The one pre-heater and the induced draft fan serves for both units or for either one of the two units if only one unit is in operation. The pre-heater contains 740 2½-in. boiler tubes expended into ⅜-in. steel plate heads, the gases passing through these tubes on their way to the stack. The air supply for the forced draft fan is taken through a duct leading from the ceiling of the upper floor to the pre-heater, thus removing all the foul air from the building that might come from the refuse as delivered. This air is drawn through the pre-heater around the tubes through which the hot gases are passing, taking up enough of this heat from the waste gases to raise the temperature of the air going into the forced draft fan to the temperature of from 150 to 400 deg. F. The forced draft fan forces this heated air through concrete ducts below the floor to the ash pits of the two incinerators. It enters the pits directly under the grates through suitable control nozzles at a maximum pressure of 4½ inches. It might be stated that the ash pits of each incinerator are divided into sections so that the forced draft can be shut off entirely, in any one section and the fire cleaned on that section of grates without hindering the operation of the other sections of the grate. The use of this hot forced draft has shown itself to be the most essential feature in the burning of manure and the saving of additional fuel. In case only natural draft is used, as in starting up when the steam pressure is down, an opening is provided to the outside of the building so that air can be drawn directly into the ash-pit, thereby removing the necessity of opening the ash-pit doors. This feature is especially valuable in the winter time when the lower floor is well sealed up to prevent the cold air from coming into the building.

Each unit is also provided with a by-pass direct from the respective combustion chambers to the chimney, thereby enabling the boilers and pre-heater to be entirely cut out in case, for any reason, repairs should be necessary, or if occasion should arise, the boilers and incinerators can be operated entirely independent of each other.

The boilers are installed to work at 160 lbs. pressure per square inch; the ultimate plan being, as stated, to use the steam from the boilers for the generation of the electric current for the sewage pumps. The generator set has not yet been installed but very likely will be in the near future.

The incinerators are designed to operate at 100 lbs. per square inch steam pressure, but in the continuous operation of the plant as a steam generating station each incinerator operates as a feed water heater for its respective boiler, and fans being operated by the steam from the boilers. The piping is arranged so that in starting up the plant, or, when the boilers are shut down, the incinerators can furnish the necessary steam for the fans and pumps.

The blow-offs from the incinerators lead into the respective combustion chambers and those from the boilers lead to the atmosphere through a 5-in. pipe. The exhausts from the pumps and fan engines pass through a 6-in. pipe directly into the base of the chimney.

A men's room containing toilets, wash stands and lockers, as well as other modern conveniences is provided on the operating floor.

The installation of the complete equipment, except the old incinerator, was completed Dec. 1, 1913, and the plant commenced operation that day. It was agreed by the city that a test of the capacity for the 60-ton unit would determine the fulfilment of the guarantees as the city could not without great inconvenience supply more than 60 tons of refuse in 24 hours. The 50-ton unit could not be dismantled at the old plant until the new plant was in operation and consequently the installation of the old unit in the new plant has just recently been completed after it has been overhauled and equipped with the new system of piping.

Refuse Hauling

Near the site of the street car barns the city has erected a loading station and a stable, and it is here that collection wagons deliver their loads of refuse into the dump-cars.

The loading station is a brick and reinforced concrete building two storeys high, 46 ft. x 146 ft., and was erected at a cost of $16,000. A siding of the Municipal Street Railway runs through the building at ground level and in this siding are placed the 5-cu. yd. steel dump-cars especially designed for this service. The loaded collection wagons enter on the second floor by means of an approach at the end of the building and dump their contents directly into the cars.

The stable is also of brick construction erected at a cost of $23,000 and provided with single stalls for 32 teams, together with 4 box stalls. The wagons are housed under the second floor of the loading station.

Test Data

The first of the three test periods held on the new plant occurred on Dec. 1, 1913, under the supervision of the builders, with the following results:

Date of test—December 1, 1913.
Duration of test, hours—22.
Grate area, sq. ft.—108.
Material incinerated—

Manure, lbs.	57,240
Garbage, lbs.	55,480
Fruit, lbs.	2,800
Fish, lbs.	3,500
Horses, lbs.	1,500
Total material destroyed, tons	60.26
Percentage of manure	47.5
Percentage of ash	10.0
Refuse burned per hour, tons	2.74
Equivalent incineration in 24 hours, tons	65.76
Labor required—	
One engineer 22 hours at 50 cents	$11.00
Three firemen 22 hours at 30 cents	19.80
Labor cost per ton, cents	51.1
Cost of fuel required—200 lbs. coal and ¼ cord kindling	$3.00
Total cost of fuel	$3.00
Fuel cost per ton refuse, cents	.049
Total cost of operation per ton refuse, cents	.56

Although this first test fulfilled the guarantees of the builders the city desired to run another test with the regular city crew operating the plant. They also desired to have the requisite quantity of manure on hand to make up the 60 per cent. that was stipulated in the contract. Consequently on December 12, 1913, a second test was run with the city's crew operating the fires, the following results being obtained:

Date of test—December 12, 1913.
Duration of test hours—9.5.
Grate area, sq. ft.—108.
Material incinerated—

Manure, lbs.	23,310
Garbage and refuse, lbs.	24,460
Total, lbs.	47,770
Total material destroyed, hours	23.89
Percentage of manure	48.8
Percentage of ash	10.0
Refuse burned per hour, tons	2.51
Equiv. incineration in 24 hours, tons	60.24
Refuse burned per sq. ft. grate per hour, lbs.	46.5
Labor required—	
Engineer, 9½ hours at 50 cents	$ 4.75
Three firemen 9½ hours each at 25 cents	7.12
	$11.87
Labor cost per ton, cents	49.7
Fuel required—No coal used. Small amount of kindling wood to start.	
Total cost fuel required, dollars	0.50
Total cost per ton refuse, cents	2.1
Total cost of operation, per ton, cents	51.8

The plant demonstrated in this second test that it could be operated within the guaranteed cost by the city's men, but again the 60 per cent. of manure was not available. Consequently a third and final test was held on January 7, 1914, the results being as follows:

Date of test—January 7-8, 1914.
Duration of test, hours—19.0
Grate area in sq. ft.—108.
Material incinerated—

Garbage and refuse, lbs.	48,870
Manure, lbs.	74,100
Total lbs.	122,970
Total material destroyed, tons	61.49
Percentage of manure	60.3
Percentage of ash	10
Refuse burned per hour, tons	3.24
Equiv. incineration in 24 hours, tons	77.76
Refuse burned per sq. ft. grate per hour, lbs.	60.0
Labor required—	
One engineer 19 hours at 50 cents	$9.50
Two firemen 19 hours at 25 cents	9.50
	$19.00
Labor cost per ton, cents	30.9
Fuel required—	
½ cord wood	$4.00
200 lbs. coal	1.00
Total cost of fuel required, dollars	5.00
Fuel cost per ton refuse, cents	8.1
Total cost operation per ton refuse, cents	39.0

The information given in this article was furnished Engineering and Contracting by the Stacy-Bates Company of Minneapolis.

There are several railway gages in Europe, but in the United States and Canada it is possible for a truck to travel from Prince Rupert to New Orleans, and from Quebec to San Francisco without hindrance. This was accomplished at great expense some twenty or thirty years ago. In Europe the bulk of the mileage is the standard 4 ft. 8½-in. gage. There are, however, some other gages, especially the meter gage in France, Belgium, Italy, Spain and Portugal. The most important exceptions are in Spain and Portugal, where they have nearly 10,000 miles of the 5 ft. 6-in. gage, and in Russia and Finland, where there are 30,000 miles of the 5-ft. gage. This 3½-in. difference from the standard was adopted by the Russian Government to avoid the dangers of invasion. The only connection between France and Spain is at Irun, on the Biscayan coast, but the Pyrenees are now being pierced at more than one place, and a question of conforming the gage of Spain and Portugal to that of the bulk of Europe has arisen.

An Outline of Present-Day Practice in Water Filtration

PRESENT-DAY practice in water filtration was the subject of an interesting paper read by Mr. G. A. Johnson at the recent convention of the American Waterworks Association. Mr. Johnson began with a history of filtration abroad, followed by that of United States cities, the latter beginning in 1875 with the Poughkeepsie slow sand filter. He gave a brief description and statement of the operation of most of the larger filters, both slow sand and rapid, which have been constructed since that time. These included the slow sand filters at Lawrence, Mass., Albany, N.Y., Washington, D.C., Philadelphia, Pa., and Pittsburg, Pa. The rapid sand filters specially described were those of Little Falls, N.J., New Orleans, La., Cincinnati, O., Louisville, Ky., and Columbus, O. In this connection he gave a list of all the filter plants, both slow and rapid, which have been constructed in the United States. Space does not permit more than a gleaning of a few of the more interesting statements from the paper.

Concerning the Philadelphia plant, he stated that when the turbidity of the Delaware river exceeds 100 parts per million for prolonged periods, the Torresdale plant is utterly unable to cope with the problem. The pre-filters fail to do their proportion of the work and the slow sand filters choke badly and allow fine silt to pass to a depth as great as ten inches.

Concerning the Pittsburg filters, he stated that actual experience with them had failed to confirm the judgment of the filtration commission in adopting slow rather than rapid sand. The bacterial efficiency was poor and on one day in December, 1909, 120,000 bacteria per c.c. were found in the filtered water, and the use of hypochlorite was begun. This plant, he said, was watched more carefully than almost any other in existence, and this more than anything else prevented the signal failure of the plant, but it required a high grade of technical skill to enable the works to handle this, the most difficult water which a slow sand filter plant is called upon to purify in this country. The problem was studied during 1910 and 1911 as a result of which, preliminary filters and latitudinal baffles were built, this work being practically completed last December and there still remaining to be installed appliances for introducing coagulating and correcting chemicals. In spite of these difficulties, the use of the filtration plant has reduced the typhoid fever rate from an average of 125 per 100,000 for the nine years before filtration to an average of 10 for the four years succeeding filtration—a result never equalled in the history of water purification.

The first municipal rapid sand filtration plant was built at Somerville, N.J., in 1885, and up to January, 1914, more than 450 municipal plants of this type had been built or were under construction, with a total daily capacity of 1,745,000,000 gallons and twelve million people supplied. About 1900 the type of construction changed abruptly from circular wooden or steel tanks to rectangular concrete tanks. The plant at Little Falls, N.J., was the first one built wherein the tanks were of rectangular concrete construction, this being completed in 1902. In numerous respects all of the rapid sand filter plants built since then have been patterned after this with respect to the scheme of layout and the automatic or easily manipulated hydraulic and electrical contrivances. This plant serves several cities, the largest of which is Paterson, and the average death rate from typhoid fever in this city for the five years prior to filtration was 32, which was reduced to 9 for the ten years following filtration.

In the New Orleans, La., plant, lime and sulphate of iron are used as coagulants and the filters are cleaned by water alone under high velocity. The amount of wash water used averages the very low figure of 0.4 per cent. of that filtered, this being due to the very complete preparatory treatment of the water in sedimentation and coagulating basins prior to its application to the filters. The use of the filtered public supply has been taken up very slowly by the citizens, only about one-half of the population being connected at the end of 1912. Also the introduction of a new sewerage system and other sanitary improvements in the city make it uncertain how much should be credited to the water supply. In 1912, however, the typhoid fever rate was 58 per cent. less than for the thirty years previous to filtration.

The Cincinnati plant is the largest rapid sand filter in the country, although those under construction at St. Louis and Baltimore are larger; the Cincinnati plant having a daily capacity of 112 million gallons, Baltimore of 128 million and St. Louis of 160 million. In Cincinnati the raw Ohio river water is first allowed to settle for about three days in a large reservoir, coagulant is then added and from two to three hours allowed for coagulation and supplementary sedimentation, and the water is then applied to the filters. Three and a half per cent. of wash water is used. The turbidity is reduced from 190 to zero, the bacteria from 8,900 to 75, these being averages for the year 1910. The typhoid fever rate has been reduced from an average of 55 for the eight years previous to filtration to 11 for the five years following.

The Louisville, Ky., plant was placed in operation in 1909. The wash water used averaged 2.37 per cent. during 1911, and the turbidity was reduced from an average of 225 to zero and the bacteria from 10,300 to 135. The typhoid death rate was reduced from 56 for the ten years previous to filtration to an average of 25 for the three years following.

The Columbus, O., plant was put into operation in 1908, and it is designed to soften the river water as well as to clarify and otherwise purify it. This water is not only frequently muddy, but is one of the hardest in the country. The average amount of chemical used in 1911 was 7.5 parts of lime, 4.3 of soda ash and 1.57 of sulphate of alumina. On the average the turbidity was reduced from 68 to 0, hardness from 245 to 84, alkalinity from 150 to 45, incrustants from 45 to 38 and bacteria from 11,470 to 55. The typhoid death rate has been reduced from an average of 62 for the nine years preceding filtration to 17 for the four years following.

Concerning the use of coagulants, Mr. Johnson states that the chemicals most commonly used are compounds of aluminum and iron, of which potash, alum, sulphate of alumina and sulphate of iron are those most extensively employed. The essential feature in selecting chemicals is that the chemical shall be basic, namely, that it shall contain more available alumina or iron than is required to combine with dissolved sulphuric acid, and that it shall contain no free sulphuric acid.

Under some circumstances the carbonic acid liberated by the application of chemicals increases somewhat the rate at which the water corrodes some unprotected metals, although no more so than the best ground water supplies to the country. The carbonic acid may be removed by the addition of lime. For ordinary uses no change as regards hardness due to coagulants can be detected, but where water is boiled or used for steam raising purposes, it is a little less satisfactory after coagulation on account of the increased amounts of incrustants, although the increase is very small.

To obtain satisfactory results from the use of lime and iron as coagulants, it is necessary to add sufficient lime to neutralize and precipitate the iron. This must be done carefully, for the use of too little lime results in poor coagulation caused by the incomplete precipitation of iron, some of which may appear in the effluent of the coagulating basin, while too much lime causes incrustants to form, which are liable to cause trouble by being deposited in the sand bed and in pipes and valves.

Where waters are very muddy it is desirable to precede the filtration by sedimentation, and if this is to be aided by preliminary coagulation the sedimentation basins must be sufficiently large to permit of adequate subsidence of coagulated matter before the water reaches the filters. Otherwise, the filters will clog too quickly and require too frequent cleaning. The basins should be well baffled and have a capacity of 18 to 24 hours' flow, or several days' flow if not well baffled. The use of coagulants in this way before applying water to slow sand filters is quite successfully practiced at Springfield, Mass., Ferncliff and Poughkeepsie, N.Y., Indianapolis, Ind., Washington, D.C., and elsewhere.

Concerning the so-called red water plague, Mr. Johnson states that where sulphates of iron or alumina are used in the preparation of water for filtration and lime or soda are not also used, there is an increase in the amount of carbonic acid of three to four parts per million for each grain of coagulant used per gallon of water, and this free carbonic acid increases the corrosive action of water on metals. He disputes, however, the claim made that coagulating water is responsible for the more or less common run of red water troubles, but believes that these would in most cases be experienced without coagulation.

Cost Data

Concerning the costs of slow and rapid sand filters, he makes a comparison including in each case the buildings, filters and all appurtenances, preliminary sedimentation basins, filters and clear water reservoirs. The greater area required for slow sand filters makes the land required cost about twenty times as much as for slow sand, and furthermore makes it more difficult to find a site for the filters without going long distances. He presents a table of costs of seven slow sand filters and eight rapid sand filters, the construction costs given by him ranging from $20,000 per million gallons daily capacity to $45,200 for slow sand filters, and from $10,300 to $15,000 for rapid sand filters, the averages for the two sets being $32,600 and $12,100 respectively. At 5 per cent. the fixed charges on these sums would amount to $4.47 and $1.66 respectively per million gallons filtered. He likewise gives the cost of operation and maintenance of the seven slow filters and of five rapid filters, the former varying from $1.91 to $5.62 per million gallons filtered, and the latter from $3.20 to $6.32, the averages being $2.86 for slow sand and $4.04 for rapid sand. Adding these two cost figures, we have a total of $7.33 per million gallons for slow sand filtration and $5.70 for rapid sand.

Concerning the relative efficiency, he claims that well designed and built rapid filter plants not only can purify water of any character, turbid, colored or clear, so that the filtered product will always be clear and colorless, but also are less liable to show sharp diminuation in bacterial efficiency in cold winter months or when the character of the raw water is seriously contaminated with certain industrial wastes. "Wherever chemicals are or should be used in the preparation of water for filtration, it is proof that the slow sand filter is out of its element and in a field which, on grounds of economy at least, belongs exclusively to the rapid sand system." He compares the reduction in the typhoid death rates by seven slow and six rapid sand filters, and finds that the average rates after filtration are 22 for the slow sand filters and 16 for the rapid sand. He uses this as an argument in favor of rapid sand, but fails to call attention to the fact that the average rates before filtration were 81 in the cities where slow sand filters were built, and only 44 in those where rapid sand filters were adopted; a comparison of these averages showing that while the slow sand filters reduced the death rate by 73 per cent., the rapid sand reduced it by only 64 per cent.

Discussion

In discussing this paper, the point which received the most attention was the comparative costs of filters, and it seemed to be the general, if not universal, opinion that the author had not made a fair presentation of this question; that is, the figures given for slow sand were too high and those given for rapid sand much too low. The discussion was opened by J. H. Gregory, who stated in substance that land for slow sand filters was not often difficult to obtain, and that quite commonly it was found as cheap to purchase an area large enough for a slow sand filter as to obtain a smaller portion of a tract sufficient for the rapid filter only; citing as instances, Pittsburg, Philadelphia and New York, several sites being found by the latter city for filtering the Croton supply and also in the Catskills for the new supply. At Cincinnati land was found equally available for either slow or rapid filters, also at Columbus, and at the latter city sufficient area was taken for slow filters, although rapid ones were used.

The cost, Mr. Gregory said, depends largely on the capacity of the coagulating and clear water reservoirs. These were nine times as large in New Orleans as at Little Falls, which accounts largely for the difference in cost. At Philadelphia the puddling of the filter walls and other special construction (and politics, said John Trautwine, Jr.) made the cost higher. At Montreal the cost of slow sand filters averaged only $22,630 per million gallons, including a low lift pumping station, or $21,000 without the pumping station. The cost of the Columbus plant was between $14,000 and $15,000 and not $13,000 as stated by Mr. Johnson. Other rapid sand filters were those at Toledo, O., costing $14,500 or more; Grand Rapids, costing $16,300, omitting items not chargeable to the filters. At Cincinnati the settling basins should be included as part of the plant, and including half the cost of these, gives the cost per million of $18,-

200 instead of $11,400 given by Mr. Johnson. The New Orleans plant cost only $30,160 if the non-filter structures be omitted. The weighted average of the several plants referred to by Mr. Gregory gave $18,600 as the average cost of rapid sand filters instead of $12,100 of the author; and these are all the latest and best plants of this kind. The author's figures were not only much too low for rapid sand, but were too high for slow sand filters.

Mr. J. N. Chester agreed with Mr. Gregory's conclusions in a general way, and stated that the cost of the modern large rapid sand filters was more per million gallons than the small, because more conveniences in the way of appliances for controlling the filters were being demanded. He stated that he built the third slow sand filter in the United States at Mount Vernon, the cost for 1.4 acres being $22,000, but this was built by damming off a reservoir and filling with sand which was dug on the spot. Rapid plants could be built cheaply, he said, by using wooden tanks, wrought iron pipe, etc., but cost of operation and depreciation would be high. On the other hand, $2,000 to $6,000 per million gallons is often put in a head house, administration building, hydraulic valves, etc. R. S. Weston agreed with Mr. Gregory as to the matter of cost. Some time ago he fixed upon $14,500 per million as the average cost for a rapid filter and $100,000 per acre as the average for a slow filter, and believed that the latter could be used at the rate of six million gallons per acre if hypochlorite be used for sterilizing. R. E. Milligan cited Jerome Park as a proof that large plants need not necessarily cost more per unit than small.

C. B. Burdick called attention to a common error in assuming that a plant operates at 100 per cent. of its capacity every day, stating that in practice the actual capacity was but 40 per cent. to 85 or 90 per cent. of the theoretical. Allowance for this would raise the cost per million gallons filtered. H. C. Hodgkins considered that 8 per cent. rather than 5 per cent. should be allowed for the fixed charges.

Mr. Weston said that the Pittsburg and Washington filters should have been rapid sand, while Mr. Chester said that Pittsburg was just on the limit of turbidity where this was a question. Mr. Weston set the limit of turbidity at 30, and the limit of color at 50, above which rapid filters should be used. He agreed with Johnson that rapid filters should be used under many conditions, but advocated slow filters for clear water and where sand and construction were low.

Mr. Milligan advocated rapid filters at a 240-million gallon rate for removing iron instead of slow filters at a 10-million gallon rate. He also believed that pressure filters would again become popular, with the effluent probably sterilized. Paul Hansen thought pressure filters should be adopted with caution, as they do not allow of coagulation and sedimentation prior to filtration. Mr. Chester agreed with Hr. Hansen in opposing the use of pressure filters, one objection being that he has always found unwashed sand in the bulge of horizontal cylindrical filters.

W. C. Hawley stated that if the decision was to be made to-day, Pittsburg would probably adopt rapid filters, briefly describing other rapid filters recently built by private plants just above Pittsburg.

Professor Dallyn did not consider the total death rate of any value as a basis of comparing improvement in health conditions due to water, unless the infant rate was excluded, since this was a very large percentage of the whole, and usually depends upon the milk supply rather than upon the water supply.

Cement Joints for Sewer Pipe at Edmonton, Alta.

By J. M. Begg[*]

THE difficulty of getting in Edmonton a sufficient number of skilled pipelayers and inspectors has led me to consider carefully present methods of making cement joints in sewer pipe. It is a simple series of operations and yet like many other simple things it is not always well done. Perhaps it is just because it is a common daily part of the work, that it is apt to be overlooked. Once a sewer is covered up, and the sewage entering it gets away freely, it is assumed that the sewer is in good working order, but that is not always so. The sewage may be getting out, or ground water may be getting in to an extent that seriously decreases the capacity of the sewer.

The common method of specifying sewer joints is to require a strand of oakum or hemp gasket all around the inner part of the joint and cement mortar to fill up the rest of the jointing space. The gasket prevents the mortar from entering the barrel of the sewer. In making a joint of this kind, the usual procedure is to dig a hole under the bell of the pipe last laid, insert the next pipe, calk the gasket all round the joint and complete the joint with cement mortar, using the hands to get it in under the pipe. From Ogden's "Sewer Construction," I take some directions typical of those which cover this method:

> All pipes and special shall be laid to the grade given by the engineer . . . special care being taken that there is no sagging of the spigot end in the hub. . . . A narrow gasket of jute shall be provided by the contractor, to be well soaked in neat cement grout and introduced between the hub and spigot, and well and properly rammed. It shall in all cases be driven to the bottom of the hub to leave room for the mortar as specified. The space between the spigot and hub shall then be entirely filled with mortar thoroughly pressed in on the bottom, sides and top, and every precaution taken to secure a watertight joint. The mortar shall be applied with a rubber mitten and rammed or compacted with a wooden calking tool. The joint shall be finished with a neat and generous bevel made with the mitten.

A careful and conscientious pipelayer can make an excellent joint in this way; but it is obvious, that, if he is at all slovenly, the lower half of the joint, which in a sewer is the vital part, is more likely to suffer. It is the most difficult part to get at, and the larger the pipe, the greater is the difficulty. The danger is increased if the contractor is pressing the pipelayer to get along quickly and if the inspector is inclined to keep to the top of the trench. From that position he cannot see what the pipelayer is doing with his hands under the pipe. On a small job, where there is ample opportunity for careful inspection, and time is available, the method is not likely to be found unsatisfactory, but with thirty or forty miles of construction to cram into six months, I have found it apt to break down here and there.

If the pipelayer has any latitude at all, as often as not he backslides and adopts another and easier method. Before laying any pipe, he places some mortar in the lower part of the bell of the pipe already laid, inserts the next pipe, and then finishes the upper part of the joint with oakum and cement, or with cement alone. Such a method leaves little chance of a leaky joint below the water run, but another danger is incurred. In the very act of inserting the pipe, the pipelayer is likely to squirt some of the mortar into the barrel of the sewer. This mortar, of course, can easily be removed with a scraper or a tight-fitting bag, but the pipelayer again may neglect to do this and the inspector may fail to detect it in one or two lengths.

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[*] Assistant City Engineer in charge of Sewers.

I do not see how one can avoid running one or other of these two dangers. The engineer, who cannot always be on the job himself, can only choose the method that seems to him to offer the least chance of being carelessly carried out. The one method—calk-oakum all round the joint before adding any mortar—involves the risk of a leaky joint, owing to the irksomeness of getting mortar into the bottom; the second method—placing mortar in the bell before introducing the next pipe—involves the risk of cement getting inside the sewer and forming a little ridge across the water run. In spite of this possibility, I have come to think this latter method the less dangerous. As a rule, not a great deal of cement does actually squirt through into the sewer, and the pipelayer has little temptation to omit cleaning out what does get in. Incidentally, I prefer the wooden scraper to the bag hauled through the sewer with a rope as pipelaying proceeds.

A Point About Bell Lining

But many engineers who specify this method of first lining the bell with cement overlook an important point. Cement mortar alone in the bell will not support the spigot end of the next pipe. The spigot sinks down into even the stiffest mortar, and if the whole line is laid in this way you get a water run like the edge of a saw. Very little pressure is required to squeeze down the pipe into the bell. If the pipelayer steps on the pipe or if the backfilling is thrown on top of it while the mortar is green, it is enough to cause it to sag, even if the weight of the pipe itself does not carry it down. It is advisable, therefore, to lay a piece of hemp, about 6 ins. long, on the lower part of the bell and then place the mortar on top of it. This may seem a clumsy proceeding but, if you try to introduce the hemp afterward, you will find you need to calk it away into the bell to raise the pipe in such a way at all. To raise the pipe with a chip of wood in the bell will not do as it lifts the spigot off the mortar, and any method of making the pipes concentric which depends on a finical trimming of the trench is not likely to be very successful.

In his "Engineering Work in Towns and Cities" (1908) Ernest McCullough quoted a specification which reads in this way:

> Joints shall be made as follows: (1) Line with mortar the lower third of the entire circumference of the bell; (2) insert the pipe to be laid and a jute gasket freshly dipped in neat grout; (3) bring the pipe to grade and line; (4) calk the gasket tightly into the joint; (5) fill the joint with mortar mixed rather stiff, using a rubber mitten; (6) tamp mortar into joint with an approved tool until it is solidly filled; (7) smooth on mortar, using a rubber mitten; (8) protect the cement (preferably with burlap) and fill around the barrel of pipe with sand or similar material, tamping solid with an approved tool; (9) remove burlap and cover joint and pipe with fine material; (10) clean out and point joint on inside of pipe.

This is a better clause than is found in most specifications, though the manner of conducting operations (2) and (3) is not very clear. Mr. McCullough, in a note, states that he fails to see the necessity for specifying a gasket in sewer-pipe joints, except when the sewer is laid in water. But, as a few minutes' experimenting on the ground will show, it is difficult to get an even water run without the gasket in the bottom. The gasket in the top half of the joint is, of course, a safeguard against cement getting into the pipe. It may be argued that as we have to clean out any cement that gets in at the lower part of the joint, a little from the upper part will not materially add to the danger; but it is advisable to reduce the danger to a minimum.

The Edmonton Specification

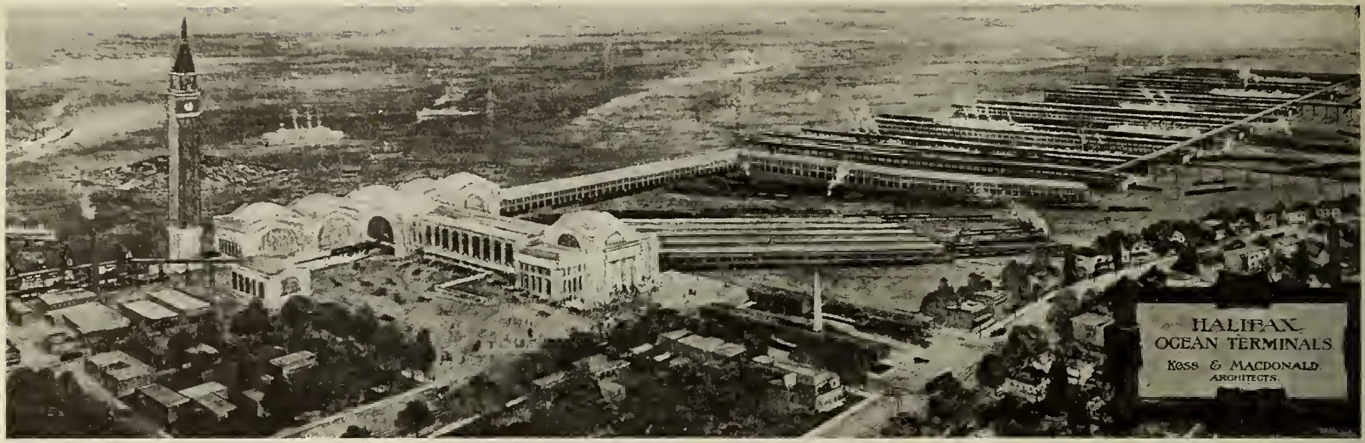
The following is the specification we use at present in Edmonton:

> The ordinary joint shall be made in the following manner:
>
> (a) Lay along the lower quarter of the bell and just at the entrance a piece of Russian hemp or other approved material freshly dipped in neat cement grout. This hemp is to keep the pipe to be laid next from sinking into the mortar in the bell and must therefore be thick enough to keep the pipes concentric.
>
> (b) Line the lower third of the bell with stiff mortar, covering completely the strand of hemp.
>
> (c) Insert the pipe to be laid, pushing it home until it is hard against the inner end of the bell. Great care must be taken to see that the spigot end of the pipe rests on top of the hemp and does not catch it and jam it back into the bell.
>
> (d) Calk into that part of the bell not already filled with mortar a strand of gasket freshly dipped in neat cement grout. This gasket after calking must not take up more than one-quarter of the space available in the bell for the whole joint.
>
> (e) Fill the joint all the way around with stiff mortar, using a rubber mitten, and finish off the outside of the joint both top and bottom with a neat bevel. But no joint is to be completed in this manner until at least two joints have been calked in advance with the gasket as described in paragraph (d).
>
> (f) Clean all cement from the inside of pipe up to 15 in. diameter by using a wooden scraper made in the form of a semi-circle. Pipes over 15 ins. and less than 22 ins. diameter to have the lower half of the joints pointed on the inside. Pipes 22 ins. diameter and over to have the joint pointed all the way around on the inside.

The method so specified is no doubt open to criticism but it is an attempt to work out a method which, taking full account of human nature and the actual conditions of pipelaying, should reduce the danger of leaky joints to a minimum. The trouble is not that a contractor may be dishonest. A good joint can be made about as easily and cheaply as a bad one. The trouble is simply that the pipelayer may find it awkward to make the bottom of the joint carefully and it is important to have a standard method that insures easy inspection and leaves as little room as possible for careless workmanship. There is nothing in the method suggested which a contractor could consider a hardship. It is easier than the method of calking a gasket all the way round before adding the cement, and it takes the same material. The latter method is almost sure to lead to leaky joints, if inspection relaxes for even a short time, or if the work is at all hurried.

It might after all be argued that the method I have recommended needs rigid inspection just as much as the other. It does need careful inspection, but this much at least can be said for it that once a pipelayer becomes accustomed to it there is little or no temptation to depart from it even if the inspector's back is turned.—Engineering News.

A miniature of the Panama Canal, built on a scale of 6½ ft. to the mile, is to be operated at San Diego, Cal., during the exposition next year. A contract for constructing the model has been awarded. The cost is estimated at no less than $250,000.



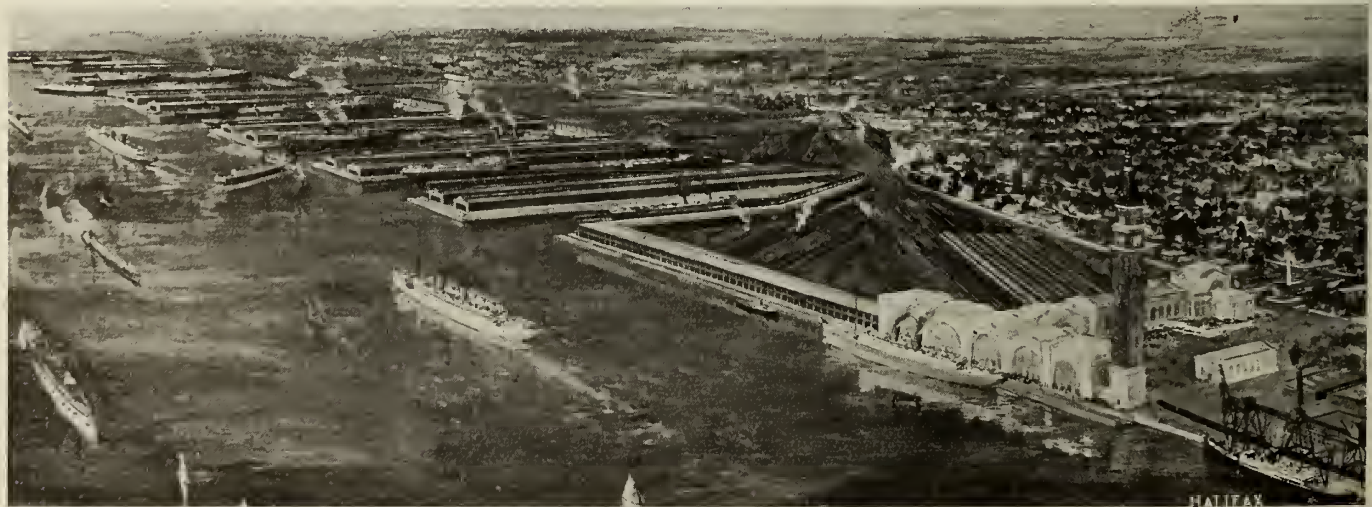
Proposed Ocean and Railway Terminals at Halifax, N. S.

THE general preliminary plans of the ocean and railway terminals at Halifax, prepared by Messrs. Ross and Macdonald, architects, Montreal, and submitted to Mr. F. P. Gutelius, General Manager, Canadian Government railways, show the large scope of this work. They also illustrate the general arrangement for the handling of passengers and freight and the facilities provided for the transferring of passengers, baggage, mail and express to and from railway trains and steamships, as well as for the provisions for the handling of local traffic.

The general scheme consists of a passenger station building in the shape of large letter "T," the foot of the "T" being at the shore end, and the head at the steamship landing stage. The shore end of the building provides accommodation for the local Halifax traffic, and contains ticket offices, baggage and parcel checking rooms, restaurant and lunch room, womens' and mens' retiring rooms with toilets, and provision on the upper floors of the building for office space required by the railway and steamship lines. This portion of the building, which will be known as the Halifax City Station, will face on a plaza located between South and Tobin streets, this plaza extending from Pleasant street east to the front of the station building, about 400 feet in depth. A place for cabs is provided on the north, with access to the baggage checking room and the ticket lobby. Passengers on entering the building will find all the facilities they require for transacting their business, after which they may pass on to the train concourse or train waiting room.

The general plan provides a landing stage approximately 2,000 feet long, which is divided into two parts; a third portion on the north will be set apart for the handling of passengers baggage, mail and express, and the remaining two-thirds devoted to the handling of cargo. It is upon this northerly end of the landing stage that the top portion of the "T"-shaped building is placed.

Passengers disembarking from steamship will enter the building at the second storey level. Passengers' baggage will be discharged at the same level and will be distributed in the usual way for customs examinations. After baggage has been passed by the customs and then checked by the railway company it will be transferred to the floor below by means of chutes or elevators to a distributing baggage room from where it will be routed to cars according to destination. Mails will be discharged directly from the steamship to a distributing mail room in the lower level of the steamship passenger building, from where they will be transferred to cars according to destination. After passengers have landed and have passed



their baggage through the customs they will pass into a booking hall containing ticket offices for the railway and steamship lines. Here passengers may obtain railroad checks for their baggage, secure their tickets and attend to other matters of transportation which they may find necessary. They will then pass into the train concourse or waiting room. This room connects the steamship station with the Halifax City Station and forms the stem of the letter "T" as stated above.

The train concourse is designed for the common use of the Halifax city traffic and the steamship passenger traffic. The floor of this room is placed level with the second storey level of the steamship passenger building, and is also level with the ticket lobby floor of the Halifax City Station. The pasengers platforms on the train shed are placed at a level between the train concourse and the baggage room beneath. All stairways have been eliminated between the train concourse level and the passenger platforms, the passengers reaching the passenger platforms by means of easy inclines. Separate tracking platforms for baggage trucks are provided, and these connect with the baggage room beneath the train concourse by similar inclines but separate from the passenger inclines, thus avoiding all confusion between passengers and baggage.

Adequate provision is made for the large number of immigrants which are expected to come through the Port of Halifax, and detention rooms and offices are provided for the various government officials connected with the immigration work, as well as separate lounge rooms, lunch rooms, sleeping rooms, toilet rooms, etc., for the immigrants themselves. These rooms are not directly connected with the other portions of the station building.

The general arrangements contemplate the erection of a separate power house for the furnishing of heat, light and power for all the buildings connected with the terminal project, a grain elevator for the handling of grain from cars to steamboats and large track provisions for handling of freight to and from the pier sheds.

The construction of the sea walls of the landing stage and the first pier has been let and the work is now under construction. The architects are at present preparing plans for all the work in connection with the buildings to be placed upon these piers. The use of local materials is contemplated as far as possible and practicable, including granite, sandstone, brick and concrete. It is expected that tenders wil be asked for shortly upon the first section of the work, comprising the Halifax City Station and the train concourse up to, but not including, the steamship passenger building. Other parts of the work will be let as fast as progress upon the piers warrants.

Selection and Use of Concreting Materials at the McKeesport Water Softening and Filtration Works

THE water softening and filtration plant at McKeesport, Pa., was placed in operation in October, 1908. The present notes on the selection and use of concreting materials for this plant abstracted by Engineering and Contracting, from a description of the design, construction and operation of the plant prepared by E. C. Trax, chemical engineer, are of interest to all who have occasion to seek watertightness in reinforced concrete construction.

The fundamental principles underlying the design of the reinforced concrete were given careful consideration from both the metal and the concrete standpoint.

Mild steel was adopted, first, because of the possible vibrations due to the operating machinery in the floor system; second, because of the probability of securing a steel of more even structure; third, because low carbon steel is more easily bent, facilitating construction.

The selection of the aggregates for the concrete was also given careful consideration, and a practice was adopted a little out of the customary. The gravel and sand used for the concrete came from the Allegheny River, and it was necessary to screen it before it was used. We required that the gravel range in size from ¼ to 2½ ins. with not more than half of it to pass a 1-in. mesh, and thus insured a more uniform mixture.

Much of the concrete used in the construction was for 6-in. floor slabs, 8-in. tank walls, and for work in general where the percentage of steel was 1.2. There was some criticism from time to time because of the adoption of the large stone, but the mixture took care of the large stone satisfactorily, without voids, due to the proper placing of the concrete around the steel reinforcement. This was watched very closely, and upon the removal of forms, the percentage of honeycomb was less than in other construction inspected from time to time where the maximum size of stone was 1 in. As this practice was more or less unusual, careful inspections were made from time to time to see that the finished concrete was satisfactory. To test for internal voids, several openings were cut through the walls, and in no instance were any found.

Satisfying ourselves in respect to the freedom from honeycombing by using larger stones, we also satisfied ourselves that this proportioning of the aggregates was the best for all practical purposes and convenience of construction. As the general practice recommends a maximum size stone averaging from 1 in. to 1½ ins., tests were therefore made to determine also whether or not the concrete was the best mixture. These tests showed that with stone of the maximum size of 2¼ ins. to 2½ ins., a stronger concrete was procured than with stone of a maximum diameter of 1 in. and 1½ ins. Mechanical analyses were made of the sand and gravel, and from time to time we had to change the mixture due to the slight changes in the proportions of the constituent parts of the gravel. These tests corroborated the findings of W. B. Fuller, published in the Transactions of the Am. Soc. of C. E., in which he shows that for an equal strength of concrete with 1-in. gravel it required 17 per cent more cement than with a maximum size of 2½ ins., and that a concrete with a maximum size of 2½ ins. required 33 per cent less cement than concrete with 1-in. maximum size gravel.

As an example of the success of this method, one of the main circular walls was 24 ft. in height and 13 ins. thick, reinforced with ¾-in. rods both horizontal and vertical. An approximate 1:3:5 mixture was used. It was deposited from the top and fell the entire height. Upon the removing of the forms, no honeycomb surfaces were found. The concrete was mixed quite wet, using as much water as it would hold and great care was taken not to give it an excessive tamping.

Proper consideration was given to the matter of building forms. To build the forms part way up and deposit the concrete at different intervals in the height, required a costly biulding and changing of runways. It also made it absolutely necessary to have a horizontal joint in the concrete whenever the runway was changed. Horizontal joints should be avoided whereever possible; when vertical joints are used keys should be placed in the forms. In no instance did the vertical joints give any trouble whatever. In the few instances where horizontal joints were necessary, great care was taken to wash the old concrete surface thoroughly clean before the placement of fresh concrete. Even after taking this precaution, however, some leakage was found in the horizontal joints. It was finally decided in all instances to build the forms continuous from top to bottom and to place all concrete in the section of the wall so that a complete vertical section could be finished in one day's work. By taking great care in the proper placing and tamping of the concrete, we obtained a wall of quite even texture which gave good results when subjected to the pressure even of clear water.

The method of tamping the concrete was a little contrary to ordinary practice. At first the spade method was used by inserting a sheet of steel about ¼-in. thick between the concrete and the form. This gave a finished surface which did not have any honeycomb, but invariably gave a surface showing a sand deposit which could readily be rubbed off. This form of tamping was finally abandoned and wooden tampers were used with an iron shoe on the end 1 x 6 ins., and instead of inserting this tamper between the concrete and forms, the concrete was pushed against the forms. This prevented the separation of the cement from the sand, and upon the removal of the forms the concrete gave a harder, more metallic appearance. In concluding to construct the forms so as to permit the depositing of concrete from top to bottom in one operation, a question presented itself, whether or not it would be better to build the forms in one piece or in sections. As before stated, the section scheme was finally adopted. The sections averaged 6 ft. high and 8 ft. long. The ribs were cut off to the radii, and the lagging placed on always in a vertical direction; in a few instances the lagging was placed on horizontally or bent to the curvature of the form, but the results were quite unsatisfactory; the tendency to become straight pulled the section out of its true curvature.

The concrete throughout the structure varies in classification and includes groined and plain arches, retaining walls, tanks, cantilever constructions, columns, beams, and floor slabs.

An exceptionally large reinforced concrete reservoir is to be constructed for the city of Dubuque, Ia. It will be circular in shape, 180 ft. internal diameter and 41 ft. deep. It will be of the buttress type, with 32 buttresses. The walls will be 12 inches thick for the top section, 24 inches thick for the bottom section and 16 inches thick in rock. The reinforcement will be round steel bars. In preparing for the reservoir it will be necessary to go down 8 to 15 feet in rock. There also will be a shaft and gate house and a tunnel about 220 feet long in rock. The approximate quantities include 15,000 cu. yds. rock excavation, 30,000 cu. yds. earth excavation, and 2,250 cu. yds. concrete. The reservoir will have a capacity of 7,500,000 gals.

Water Level Indicators and Recorders

THE conservation of water supplies is one of increasing interest in the Dominion, and anything that tends toward the prevention of wastage, or in any way adds to the efficiency of waterworks equipment, should be worth the attention of all those engaged in the design and control of public water supplies.

For upwards of forty years Messrs. Gent & Company, Limited, of Faraday Works, Leicester, Eng., have made a close study of apparatus for indicating or recording water levels in reservoirs, impounding tanks, deep wells, etc. One of their most popular instruments is the "Borough" Water Level Transmitter, shown in Fig. 1. The function of this instrument is to indicate locally, and transmit to a distance when required, the exact height of the water in the reservoir. As will be seen, the instrument is operated by a float, which rises and falls with the varying level of the water. The movement of the float is transmitted to the indicating gear by means of a special chain of accurate pitch, and a weight, which keeps the chain taut over the sprocket wheel. The wheel is geared on to a spindle which operates contacts for every one inch rise and fall of the water. An indicating dial is also connected by gearing to the spindle, showing in feet and inches the exact level of the water. When it is required to transmit this information to a distant point, a receiving indicator, shown in Fig. 2, is fixed in the Engineer's office, pumping station, or wherever the information is required, and this is connected by a single wire and an earth return, to the transmitting instrument. At every inch rise and fall a circuit is completed which moves the hands of the indicator by means of stepping magnets, either backwards or forwards, according to whether the level of the water is

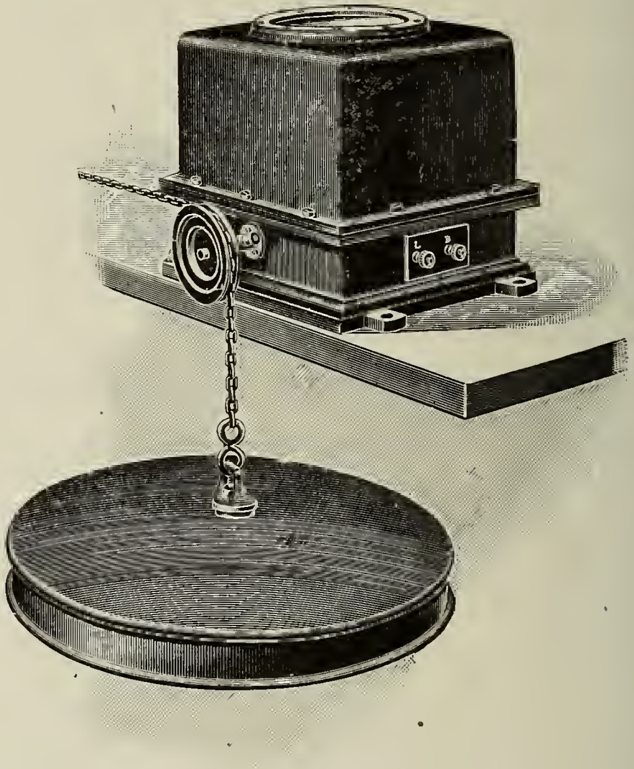


Fig. 1.—"Borough" Water Level Transmitter.

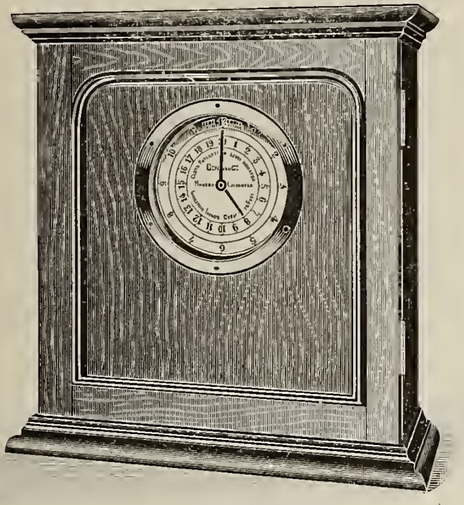


Fig. 2.—Receiving Indicator.

rising or falling. If a permanent record be required, instead of the indicator, a recording instrument is provided, as shown in Fig. 3. This apparatus is actuated in a manner similar to the indicator, and a pen is caused to travel up and down according to the fluctuations of the water level. A chart, fixed to a revolving drum, causes the pen to describe an accurate record of the impulses received. These charts, carefully filed for reference, form a valuable record of statistics as to variations due to weather and sudden demands. Limitations of space prevent our making a more comprehensive survey of the productions of this firm, but their Catalogue 6, on Water Level and Sewage Recorders, contains prices and particulars of a range of instruments for every purpose of gauging and recording, both for Water-Works and Sewage Disposal Plants, and should find a place among the files of every Engineer interested in the building and control of such systems.

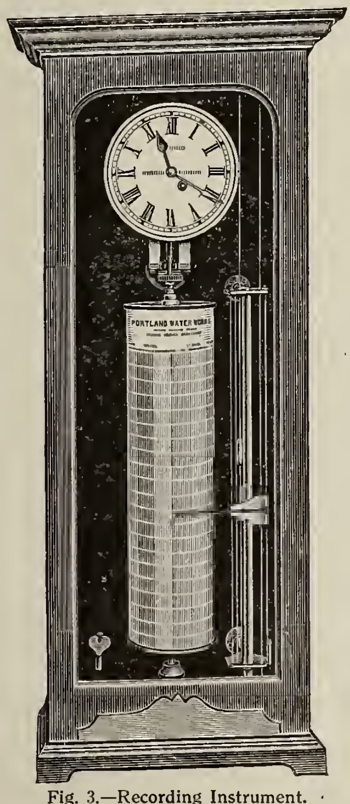


Fig. 3.—Recording Instrument.

Sewer Construction and Sewage Treatment

IN discussing the subject of sewage disposal in Philadelphia recently, George S. Webster, Chief of the Bureau of Surveys, called attention to the desirability of constructing sewers with smooth interiors and keeping them clean and inoffensive for the purpose of insuring that the sewage which reaches the station will not contain products of putrefaction originating in deposits anywhere in the sewerage system. This applies especially to deposits in depressions or irregularities in the sewers and directs attention to the importance of using materials and methods which will insure against roughness of material or depressions in grade which will cause the pooling of sewage or the formation of deposits which are not carried along by the ordinary flow of two or three feet per second. Engineers are already familiar with the desirability of such construction in order to avoid objectionable odors, but with the increasing number of treatment plants throughout the country, and especially of sprinkling filters where the spraying gives abundant opportunity for the escape of gases, it is especially important that the sewage reach the plant in as fresh and inoffensive a condition as possible, and this adds another and very important argument towards using in every case materials which will give a smooth interior, and for care in workmanship which will insure an absolutely uniform gradient.

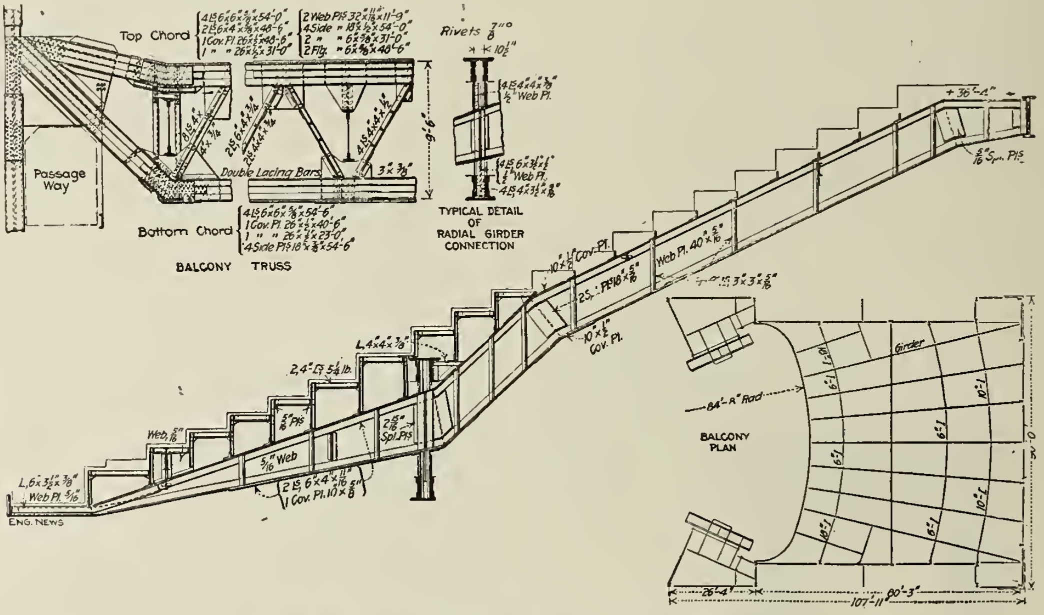
Another Aspect of Ventilation

An interesting aspect of the science of ventilation is dealt with in a recent article in the Times. Some little while ago, we are told, a number of students of London Hospital entered a cabinet, which was then closed. In the course of half an hour the atmosphere became oppressive. No fresh air was admitted, but an electric fan was started inside the cabinet. The movement of the air caused by the fan is said to have entirely removed this sense of oppression. Hitherto, we learn, an atmosphere was considered healthy or unhealthy according to the constituents of which it was formed, but to-day we know that the essential point is to keep the air in motion. From this the moral is drawn that the problem of ventilation is the avoidance of stagnation of air. Stagnation, of course, whether of air or of water, of mind or of body, is inimical to health; but the problem of ventilation has other factors. The experiment recorded is valuable as far as it goes, but it is a pity it did not go further. No doubt the immediate effect of the fan was as described, but it would have been still more valuable to know how long that effect could be maintained without the admission of fresh air. It is just possible that after the lapse of an hour or two the victims of this experiment would revert to their former belief in the importance of the chemical constituents of the atmosphere, and be disposed to think a little more oxygen, however, stagnant, preferable to too much carbonic acid, however violently it might be agitated by an electric fan. At any rate, there seems no proof that movement alone will keep pure for any length of time the air of a crowded room.

Balcony Framing, McBride Theatre, Victoria, B. C.

SOME interesting balcony-framing features are found in the McBride Theatre, recently built in Victoria, B.C., by the Victoria Opera House Company, Limited. Following the general modern practice, the balcony is supported by a transverse truss, eliminating columns in the clear space of the auditorium below; radial cantilever girders resting on this truss and anchored in the back wall, support the balcony floor-beams. The radial girders are of unusually long overhang—up to 31 ft. at the maximum—and because of the mezzanine foyer below, they are of peculiar shape.

The theatre building is 90 ft. wide by 150 ft. long. The small-scale plan in the drawing herewith shows the arrangement of the balcony framing. The balcony-truss columns are set a short distance inside the side walls. The truss is 74 ft. 10 in. long c. to c. of end columns; its effective depth is about 8½ ft. There are seven radial girders of full length to back wall, and two auxiliary radials so located that they could not receive wall anchorage. The back end of each auxiliary radial is supported and anchored by a short loading girder in the plant of the floor-beams, while the middle of the radial is suspended from an 18-in. I-beam set just above the regular floor-beams and concealed under the second step of the balcony.



Balcony truss and cantilever girders on McBride theatre.

The roof column just back of the boxes has the balcony fascia girder attached to it, but is stiffened in both directions, transversely by a beam connecting it with the wall column and longitudinally by a 15-in. floor-beam. The fascia girder is a light 16-in. plate-girder.

The Warren-system web of the balcony truss gives room for passing the radial girder between the chords, without interfering with the truss members. It is fastened by shoe and stay-gusset connections to the lower and upper chords. This position of the radial girder brings it considerably below the stepping of the balcony. In consequence, back to the balcony truss, where the mezzanine foyer required increased clearance, the line of the radial girder is offset upward, producing a reversed bend in the outline of the girder. The splices at the angles do not involve any particular complication.

The radial girders weigh about 6½ tons each. They were shipped and erected entire.

The balcony truss, whose makeup will be clear from the drawing, has its end panels sloped up, which gives it a sagging shape. Inclined passage-way (in place of steps) from the street level to the balcony cross under the balcony truss at the ends at about the level of the bottom chord, and the headroom needed for these passage-ways required the truss to be sloped up. Since the balcony floor is a curved surface, the clearance over the truss increases at the sides sufficiently to give ample room for the sloped panel.

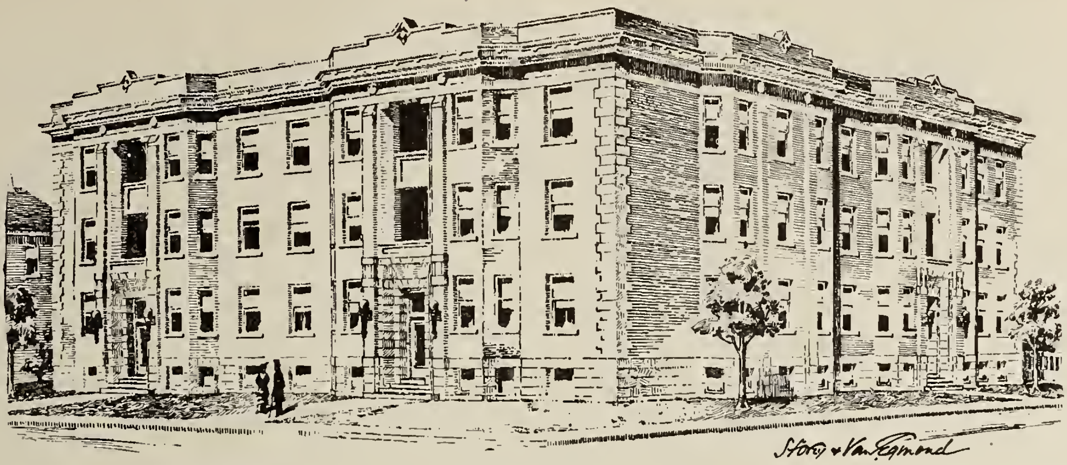
The total weight of the balcony truss is 51 tons. The truss was assembled in the shop and all connection holes reamed to match, then knocked down, shipped in separate pieces, and erected in the field.

The roof and floors throughout the building are reinforced-concrete slabs with triangle-mesh reinforcing.

The McBride Theatre cost $400,000. It is considered to be one of the finest buildings of its kind on the Pacific Coast. The steel framework has a total weight of 500 tons. The foundations are concrete piers through mud to bedrock, 20 to 50 ft. below sidewalk. They are constructed by sinking open cylinders and filling them with concrete after reaching rock.

Rochfort & Sankey, of Victoria, B.C., were architects for the theatre, and H. W. Bittman, of Seattle, Wash., was structural engineer. Pinney & McLellan were the general contractors, while E. E. Davis & Company erected the steelwork.

In the year 1913, according to a report recently issued by the American Wood Preservers' Association in co-operation with the U. S. Forest Service, ninety-three wood-preserving plants consumed more than 108,000,000 gal. of creosote oil, 26,000,000 lb. of dry zinc chloride and nearly 4,000,000 gal. of other liquid preservatives. With these the plants treated more than 153,000,000 cu. ft. of timber, or about 23 per cent more than in 1912.



Apartment building to be erected at Regina for Mr. J. S. Bartleman. Estimated cost, $80,000. Architects, Messrs. Storey & Van Egmond.

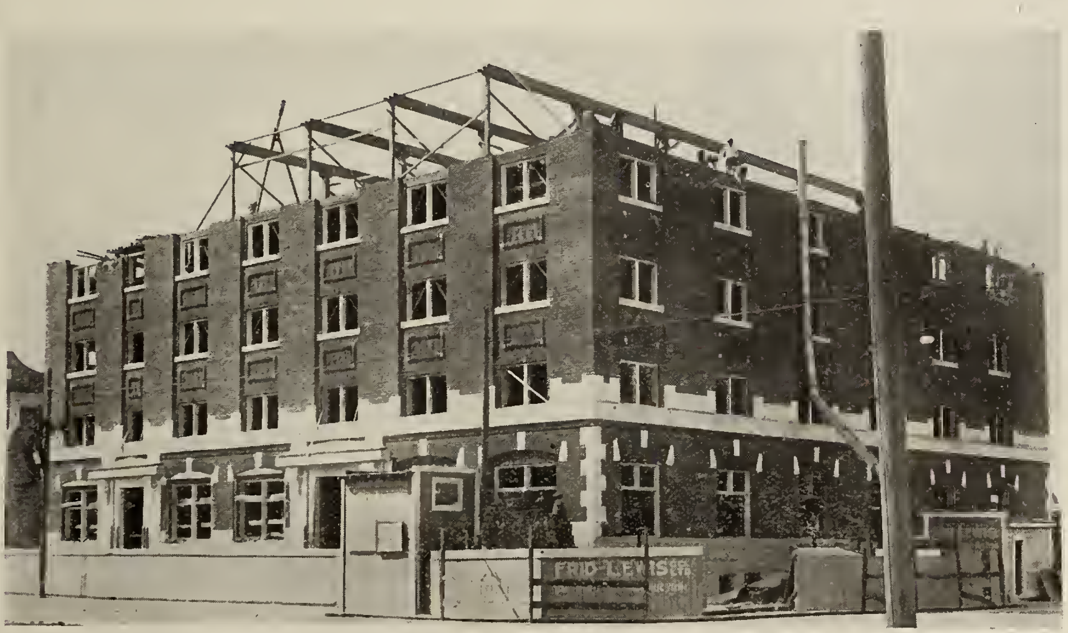
Constructional News from the Saskatchewan Capital

Correspondence of the Contract Record

REGINA, July 17, 1914.—The apartment block is becoming more and more general in Western Canada. In Regina, numerous high-class apartments have been erected during the last few years, and while apartment rents are in advance of house rent, there are always tenants to be found. One of the latest apartments undertaken is that being erected by J. S. Bartleman at a cost of $80,000. The building will be of fireproof construction throughout, with columns, beams and floors of reinforced concrete, solid brick walls and hollow tile partitions. The finish will be of oak and floors of maple. In each suite there will be a cut stone fireplace. The balconies will be located both on the front side and the rear. The rear balconies will be of concrete with iron service stairs. The exterior will be of light grey pressed brick with cut stone trimmings and entrances of cut stone. A feature of this apartment is that the rooms are outside rooms. The construction of the building is proceeding rapidly. Messrs. Storey & Van Egmond, of Regina, are the architects.

The construction of the Campbell, Wilson & Strathdee warehouse on Dewdney street is proceeding apace. This building, which is situated in the very heart of the industrial section, will be five storeys in height and 150 ft. by 125 ft. in dimensions. It is estimated that the cost will be in the neighborhood of $80,000. The Frid Lewis Company, who recently opened an office in Regina, were awarded the contract for this building and are rushing it through to completion.

The revised estimates for local improvement expenditures at Regina last year call for an aggregate expenditure



New warehouse under construction at Regina for Messrs. Campbell, Wilson & Strathdee. Estimated cost, $80,000. Messrs. Frid-Lewis Company, contractors.

of $2,337,165. Some of the larger items are: pavements, $146,906; sewage disposal works and sewer connections, $71,606; domestic sewers, $74,000; storm sewers, $82,614; waterworks, $250,000; water mains, $76,592; power plant and electric light distribution, $380,000; General Hospital, $111,084; north west fire-hall, $20,000; sidewalks, $18,570; completion of Broad street subway, $18,000; parks, $21,460; Collegiate Institute, $36,000; street railway, $51,262; Hamilton street bridge, $35,000. It is probable that the city will make arrangements for the issue of $2,000,000 treasury notes within the immediate future.

The Coste-McAuley Company has filed on about 80,000 acres of oil and gas lands northwest of Swift Current. This company will bore for gas without delay. As soon as they locate a gas flow they will lay pipe-lines from these fields to Regina in order to fulfil their cotnract with the city.

An overhead bridge across the Canadian Pacific Railway tracks at Hamilton street, Regina, will be erected within the near future. Chairman Drayton, of the Railway Commission, when in Regina, ordered City Engineer McArthur and Engineer McIntosh of the Canadian Pacific Railway to select a suitable plan for such a bridge. The engineers could not agree on matters of detail, and each will prepare a plan which will be forwarded to the Railway Commission.

Personal Mention

Mr. Lucius E. Allen, C.E., Consulting Engineer of Belleville, Ont., is at present on a trip to Europe with the object of investigating Continental methods and materials in connection with the construction of good roads and pavements.

A Contributor to This Issue

Mr. J. L. Busfield, who is now in charge of the Department of Design of the Mount Royal Tunnel & Terminal Company, Limited (Mackenzie, Mann & Company), has contributed a number of interesting technical articles to the Contract Record and Engineering Review, and other publications, and he is the author of an article on System published in this issue. Educated at Dulwich College (London, Eng.), and at the Central Technical College, he obtained the B.Sc. degree (in Engineering) with honors at London University in 1907, and in the same year was made an Associate of the City and Guilds Institute. Coming to Canada in the same year, he was made Junior Assistant to the Resident Engineer on the Eastern Division of the Grand Trunk Railway, and became Chief Assistant two year later. At that time the Eastern Division of the Grand Trunk Railway comprised the Montreal-Toronto main line, the Montreal-Portland line, the Richmond-Quebec line, and all lines east and south of Montreal. In 1912 he became identified with the Mount Royal tunnel and terminal construction as Assistant Engineer in charge of the Survey and Alignment Party of the Eastern Division. He succeeded to his present office of Assistant Engineer in charge of the Department of Design only this year. Recently he was sent to New York as one of a committee of three to study terminals, track lay-outs and construction on the principal railways in that city. He is an Associate Member of the Institution of Civil Engineers (Great Britain) and of the Canadian Society of Civil Engineers.

Mr. J. L. Busfield, Montreal.

Mr. W. J. Curle, Superintendent of Brockville, Westport & North-Western Railway, a subsidiary branch of the Canadian Northern Railway, has been notified of his appointment as Superintendent of the Canadian Northern between Toronto and Port Arthur.

Mr. H. T. Crosbie, Town Engineer of Yorkton, Sask., read a paper at a recent municipal convention in Moose Jaw on "Engineering advice to villages about to enter the town estate." He discussed in an interesting way the subject of water supply, sewerage, electric light, sidewalks and boulevards, and town planning.

Notice of the following elections to membership in the American Society of Civil Engineers has been received:—Elected Member: Mr. G. F. Palmer, Resident Engineer for Messrs. Norton, Griffith & Company, Limited, St. John, N.B. Elected Associate Member: Mr. W. E. Joyce, Engineer-in-Charge of Structural Design for the Mount Royal Tunnel & Terminal Company, Montreal; Mr. Allen van Rensselaer, with Mr. Wynne Meredith, of Messrs. Sanderson & Porter, Victoria, B.C. Transferred from Associate Member to Member: Mr. G. P. Hawley, Resident Engineer, The Cedars Rapids Manufacturing & Power Company, Cedars, Que.; Mr. Harry Sidenius, Resident Engineer, C. P. R., Department of Natural Resources, Calgary, Alta. Transferred from Junior to Associate Member: Mr. F. W. Dorrance, Principal Assistant Engineer, Montreal Filtration Works, Montreal; Mr. L. W. Klingner, Engineer to the Dominion Construction Company of Toronto, Belleville, Ont.

The International Irrigation Congress will hold its 21st annual meeting at Calgary, Alta., October 5-9. Mr. Richard W. Young, of Salt Lake City, Utah, is the President, and Mr. Arthur Hooker, Calgary, Secretary.

A party of fourteen Canadian municipal engineers and officials visited Detroit and Wayne County, Mich., recently, to inspect the comprehensive concrete road improvement system carried on there. The party was accompanied by Mr. L. S. Bruner, of the Canada Cement Company, Limited.

The Montreal Builders' Exchange have been invited by Mr. D. Norman MacVicar, chairman of the Quantity Surveying Committee of the Province of Quebec Architects' Association, to co-operate on the question of quantity surveying. The Architects' Association desire to obtain the views of contractors, who are naturally as much interested in the subject as are the architects. A committee of the Exchange has therefore been appointed to go into the entire question with the architects.

Preliminary plans for constructing a steel and concrete bridge over Johnson Creek, B.C., at an estimated cost of $450,000, have been approved. The Foundation Company of Vancouver has secured the contract for constructing a steel and concrete bridge over the Second Narrows at Vancouver, B.C., at an expenditure of $2,000,000.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The ratepayers of Hamilton will be asked to vote next month on a by-law to raise the sum of $175,000 for sewerage work east of Ottawa street.

Stratford, Ont., is to have a new garbage incinerator. The site upon which the plant will be constructed has been decided upon, and it is expected that the contract will be let shortly.

A contract award of outstanding interest is that for Section 3 of the Trent Canal (Severn Division) to Messrs. Randolph MacDonald Company, Toronto, at a figure slightly in excess of $900,000.

A permit has been issued in Toronto for the construction of a commercial school on Dewson street, at an estimated outlay of $250,000. The building will be completed in a year and a half.

The announcement is made from Montreal that the Grand Trunk Pacific Railway is now conveying passengers over an all-rail route from Fort William, Ont., to Prince George, B.C., a distance of 1,729 miles.

The permanent paving work carried out so far this year in London, Ont., is over half what it has been in the last ten years, according to a list of permanent pavements prepared by the city engineering department.

At Toronto, a site has been purchased on Carlaw avenue for the erection of a new school building estimated to cost $200,000. The Board of Education (Secretary-Treasurer, Mr. W. C. Wilkinson) are the principals in the project.

The City Council of Hull, Que., has decided to authorize the Mayor to place an order with the Canada Iron Corporation, Limited, Montreal, for a supply of iron pipe to be used in the extension of the waterworks system throughout the city.

The contract for the construction of St. Michael's Church, Montreal, a description of which was given in our last issue, has been let to the Atlas Construction Company. Messrs. Beaugrand-Champagne and Chenevert are the architects.

A report from Chatham, Ont., states that the Grand Trunk and Canadian Pacific Railways have been notified by the City Clerk to improve their railway crossings, failing which legal steps will be taken by the city to secure compulsory powers.

The contract for a new church for the R. C. Parish of Ville Emard, Montreal, has been awarded to Mr. H. Tessier, general contractor, of that city. The estimated cost of the building is $150,000. Mr. A. Bergeron, of Longue Pointe, is the architect.

At Fort William, Ont., foundation work is in progress on the Customs House, which is being erected at a cost of $175,000. The building is three storeys high, 100 x 80 feet in dimensions, of reinforced concrete, steel and brick construction. The general contractor is M. H. Braden.

Messrs. John Quinlan & Company, of Montreal, are the general contractors for an assembly hall which is to be erected in that city at a cost of $135,000. The building is to be of steel, reinforced concrete and stone construction. Mr. J. P. Hynes is the architect and St. Patrick's Parish is promoting the enterprise.

The Port Dover Brick & Tile Works were destroyed by fire recently, and a loss of $20,000 sustained. The fire is believed to have been the work of an incendiary, as the plant was operated entirely by gas and the latter had been turned off 36 hours before the outbreak. It is stated that the plant was not insured.

The "Cyclone," one of the two large hydraulic dredges under construction for harbor development work, was launched from the yards of the Polson Iron Works, Toronto, on July 13. Both dredges are being built for the Canadian Stewart Construction Company, who have the contract for the harbor front development work.

The foundation work has been completed for the Church of St. Francis d'Assissi, which is to be erected at Ottawa at an estimated cost of $156,000. The building will be of stone construction, 67 feet by 241 feet in dimensions. The architect is Mr. Charles Brodeur, of Hull, Que., and the general contractors are Messrs. Noel and Monette.

Sir Adam Beck, addressing a meeting at Bridgeport, Ont., a few days ago, made the interesting announcement that the Hydro Commission was taking steps to develop power along the French River between Georgian Bay and Lake Nipissing, and had recently received an order for 10,000 h.p. from the British-Canadian Nickel Corporation, which proposes to establish plants along the river.

The Board of Trade has announced that construction of the government wharf at Courtenay Bay will be started in May, 1915. In connection with the dredging operations the Norton-Griffiths Dredging Company have obtained a self-propelled steam hopper scow. Owing to the existence of rock on the suggested site it has been decided to begin construction three hundred feet further up towards the head of the Bay in the erection of wharves Nos. 1 and 2.

In addition to the Union Station at Toronto, the P. Lyall & Sons Construction Company, Montreal, have just secured other large contracts. The most important of these is the customs examining warehouse at Ottawa, originally let to the Simcoe Construction Company. The price is $1,173,000. The Lyall Company have obtained the contract for the Excelsior Life Insurance building, Toronto, $300,000, and the detention house, for third class passengers at Grosse Ile, P.Q., $48,000.

A new type of automatic signal has been put into service for the first time on the Grand Trunk line for handling traffic across the Victoria Jubilee Bridge on the St. Lawrence River. The apparatus is the alternating current, three position, semaphore type of signal and replaces the signal erected in 1902. The apparatus was installed by the Union Switch & Signal Company of Philadelphia, under the superintendence of Mr. R. F. Morkill, Signal Engineer of the G. T. R., and B. Wheelwright, Signal Inspector.

The Board of Control of Hamilton, Ont., are contemplating the submission of a by-law to the ratepayers next January, regarding the proposal to purchase a stone quarry and also with reference to an offer made by the Canada Crushed Stone Corporation to supply the city with crushed stone at from 85c to 90c per ton, on condition that a contract extending over five or ten years was made. The city engineer estimated the cost of the taking over of the Dunlop quarry at $122,000, or $47,000 more than the original estimate.

Work is progressing steadily on the construction of the new Quebec bridge at Neilsonville, Que. The firm of M. B. & J. T. Davis have completed the construction of the granite piers, eight in number. The main piers are ninety feet below water level and twenty-eight feet above, making a total height of 118 feet. The anchor piers are each 160 feet high with dimensions of seventy-five by thirty feet at the bottom. It is expected that Messrs. Davis will complete their part of the contract by the end of this fall. The main portion of the structure, the actual building of the bridge, is in the hands of the St. Lawrence Bridge Works Company. They are making rapid progress in arranging a special plant in the vicinity of the work. This includes an overhead crane of seventy-five tons capacity, operated by electricity and supported on steel pillars. The approach spans to the bridge, with the exception of the sidewalks, have already been completed, while the anchor arms are at present being built. The bridge proper is the cantilever and suspended centre-span type, the distance between the centres of the piers being 1,800 feet. The suspended span is 640 feet long, which is believed to be the longest centre span in the world. The length of each of the anchor arms is 515 feet, while the total length of the bridge, including approaches, will be 3,239 feet. The height from high water level to the top of the main posts is 344 feet and the clear height from the high water level to the suspended span is 150 feet. The centre span is to be constructed entirely of nickel steel to conserve weight. Each of the cantilevers will be erected as an entirely separate structure with its individual erection equipment.

WESTERN CANADA

The Vanderhoof Power Company, Limited, Victoria, B.C., have filed plans for construction of two dams (capacity 10,000 acre feet) at Fort Fraser, B.C.

The rural municipality of Assiniboia is having plans prepared for a system of sewerage and waterworks estimated to cost $500,000. The secretary of the municipality is Mr. Frank Ness, Kirkfield Park P.O., Man.

Tenders for the erection of a post-office at Prince Rupert, B.C., estimated to cost $100,000, have been extended to August 1. The building is to be four storeys and basement, of reinforced concrete, terra cotta and brick veneer construction.

The Morrison Nail and Iron Works, of Vancouver and New Westminster, are seeking a site in the latter centre on which to erect a factory with trackage facilities. They intend disposing of their property on Lulu Island and transferring the plant to New Westminster.

Plans are almost completed for the new departmental building to be erected at Calgary for the Dominion Government. The building is to be partly constructed with material taken from the old post office lately torn down, and will occupy a site at the corner of 6th Avenue and 4th Street west. The plans have been prepared in the office of Mr. Leo. Durrell.

The Saanich, B.C., Council has decided to prepare a bylaw immediately and submit it to the ratepayers in connection with the projected introduction of a water supply. The preliminary work in connection with the scheme has occupied the attention of the engineering staff for some time and it is probable that the Council will secure the necessary mandate to proceed with the work.

The Burrard Engineering Company, of Vancouver, have started operations on the contract for the laying of a steel pressure pipe line in connection with the Sooke Lake waterworks system between Humpback Reservoir and Victoria. About 400 or 500 feet of concrete and steel pipe will be laid daily by the gangs of the respective contractors, including the Pacific Lock Joint Pipe Company.

The city of Victoria, B.C., is being asked to vote on a by-law to expend approximately $400,000 towards the cost of the proposed Johnson street bridge, the entire cost of which is estimated at $750,000. Of this amount the Provincial Government will contribute $175,000; the C. P. R. $80,000, and the British Columbia Electric Company $50,000. At present it is not quite clear whether the type of structure to be erected will be of the swing or bascule type.

Building operations at Medicine Hat, Alta., have shown a satisfactory advance during the first six months of 1914, as compared with the corresponding period last year. The figures for the first half of the present year are $1,626,085 as against $1,363,225, an increase of $262,860. The increase is due largely to the unusual number of big buildings to be erected this year, while at the same time there is no apparent falling off in the number of private residences and small stores.

The Greater Winnipeg Water District Administrative Board contemplate the calling of separate tenders shortly for the construction of an aqueduct and intake from Indian Bay to Deacon. The whole undertaking involves the expenditure of about $8,729,000 and the portion dealing with the construction of the aqueduct is to be divided into five sections, exclusive of the intake, which is estimated to cost $50,000. Tenders for the works will close at noon on Saturday, September 19.

The excavating work for the new stores and offices which are to be erected at Edmonton, Alta., by Messrs. Adams Bros., at a cost of $150,000, has been completed and tenders for the superstructure are about to be called. The architects are Messrs. Barnes & Gibbs, Imperial Bank Building, Edmonton. The System M structural steel work is to be carried out by the Canadian Standard Concrete Steel Company of Winnipeg. The building will be 150 x 50 feet in dimensions and will contain four storeys and basement. The construction will be of reinforced concrete, brick and steel.

The Jeffrey Manufacturing Company, manufacturers of electric locomotives and conveying machinery, announce a change in the management of their Canadian branch, located at No. 55 Cote Street, Montreal. Mr. M. W. Sherwood, who for a number of years was assistant sales manager at the Columbus, Ohio, factory, has been placed in charge of their Montreal office, taking the place of Mr. H. W. Scott, who has resigned to establish for himself an engineering and contracting business. In the four years in which Mr. Scott has been in charge of this office, he has made a host of friends and all will wish him success in his new undertaking.

According to the engineer's statistics, the weight of granite blocks laid since the commencement of operations on the construction of the Ogden Point breakwater, B.C., amounts to 3,677 tons. Throughout June practically 2,000 tons of granite were placed in position by the divers. The work is carried out by means of a powerful steam crane operated from a big scow, and all the granite being used in the breakwater construction is procured from Hardy Island. The work is so far advanced by the contractors, Sir John Jackson, Limited, that operations will be started this month on the concrete work forming the superstructure of the great sea wall. The Associated Cement Company, of Bamberton, who are the contractors for the cement, have delivered 1,250 barrels on the site. Before use it is to undergo a twenty-eight-day test. The total amount of rubble dumped to the end of June is placed at 373,608 tons. An idea of the importance of the work can be gained when it is stated that the width of the base of the foundations is 200 feet, tapering to a height of 72 feet.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Calgary, Alta.
The city council is about to prepare by-laws providing for extensions to the waterworks in North Calgary and the Belfast sub-division, at a cost of $35,000.

Canora, Sask.
The Provincial Government Board of Highway Commrs. proposes to drain land in this vicinity, at an estimated cost of $16,996.

Edson, Alta.
A by-law has been passed by the city council providing for the expenditure of $5,160 on grading and ditching. A supply of corrugated iron pipe will be required.

Fort George, B.C.
The Fort George Citizens Water Company proposes to construct a reservoir with a capacity of 500,000 gallons. Application has been made for the use of water from the Nechako River.

Guelph, Ont.
The city council contemplates the construction of sewers at the intersection of Gordon and Wellington Sts., along Gordon St. across Gow Park and the Eramost branch of River Speed to Bridge St., and along Bridge, York and Stevenson streets.

Hamilton, Ont.
The city council has passed a by-law to raise the sum of $175,000 for sewer work east of Ottawa St. The question will be submitted to the ratepayers on August 12th.

Le Pas, Man.
Tenders will be received by H. H. Elliott, secretary-treasurer to the town council, until 6 p.m. August 11th, for the supply of (a) 2 sewage lift pumps; (b) house meters; (c) construction of sewage lift chamber and oil tank chamber. Plans and specifications are at the offices of the consulting engineers, Murphy and Underwood, Saskatoon, and the resident engineer, Le Pas.

London, Ont.
Plans are being drawn by the city council for the laying of asphalt pavement on Talbot street from Fullerton street to Oxford street.

Montreal, Que.
The Board of Commissioners will receive tenders for the construction of a subway at Park Avenue until noon, July 30th. Plans, etc., are at the office of Mr. Emile Vanier, Engineer in charge, 5 Beaver Hall Square.

Montreal, Que. (Lachine)
Tenders will be received by the city clerk, Hector Charette, until 5 p.m., July 23rd, for paving part of St. Joseph Street, from the toll gate to Stoney Point. Specifications at the office of the city engineer, or at the office of engineer, V. H. Dupont, 225 St. James St., Montreal.

Maillardville, B.C.
Plans for the construction of a water system, at a cost of $8,499, have been approved by the municipal council. The engineer is E. H. Longley.

New Glasgow, N.S.
The town council proposes to construct concrete sidewalks on Nelson and Marsh streets at an estimated cost of $3,380.

New Liskeard, Ont.
The town council proposes to lay cement pavements on Paget St. and Whitewood Ave., at an estimated cost of $3,168.

Ottawa, Ont.
The laying of tarvia pavement on Henry street between Coburg and Charlotte Sts. is being considered by the city council.

Parry Sound, Ont.
Surveys have been made by the town council with a view to the extension of watermains on several streets, at an estimated cost of $10,000. Contractors desiring to tender will receive due notice upon forwarding their names to the town clerk, Mr. E. E. Armstrong.

Prince Albert, Sask.
Tenders in connection with extensions to the watermain will be received by the city clerk, J. B. Brown, until 1 p.m. August 1st, for the supply and delivery of materials under Sections "A" and "B," and up to 1 p.m. August 15th, for the supply and delivery of materials under Sections "C" and "D." (a) Approximately 10,000 lin. ft. 8-in. cast iron water pipe, approximately 12,000 lin. ft. 6-in. cast iron water pipe, 19,000 lbs. special castings; (a1) 10,000 lin. ft. 8-in. steel water pipe, 12,000 lin. ft. 6-in. steel water pipe, 19,000 lbs. special castings for steel pipe; (b) 30 8-in. gate valves, 75 6-in. gate valves, 30 hydrants; (c) two 2,500 gallon per minute pumps with motors and piping; (d) one 14-in. Venturi meter. The engineer is Mr. Angus Smith.

Quebec, Que.
The corporation of Quebec is about to call tenders for the construction of a promenade at an estimated cost of $85,000. The engineer is Mr. W. D. Baillarge, 50 St. Louis Street.

Regina, Sask.
The previous tenders having been rejected, the waterworks department will call new tenders shortly for trenching and laying watermains in three blocks. Plans and specifications are with the superintendent, Mr. J. M. MacKay.

Sackville, N.B.
The town council is calling tenders for the construction of a concrete sidewalk 850 ft. long by 8 ft. wide. The town clerk is Mr. Thos. Murray .

St. Catharines, Ont.
The Dominion Government and the municipalities concerned contemplate the construction of a pipe line from Port Colborne to St. Catharines to supply water to the intervening towns. Negotiations with the Department of Railways and Canals are now in progress.

Sherbrooke, Que.
The city council has passed a by-law to raise the sum of $200,000 for the construction of permanent roads, sewers and sidewalks. The question will be submitted to the ratepayers on July 27.

Toronto, Ont.
Tenders will be received by the Board of Control until noon August 4th, for the construction of Garrison Creek storm overflow sewer, Sec. No. 4, and West Toronto Sewer System Div. No. 2, Storm Outlet, Sec. No. 2, through High Park. Specifications are at the office of the Commr. of Works, City Hall.

Wetaskiwin, Alta.
Notice has been submitted to the ratepayers that plank sidewalks and sewers will be constructed this year.

Winnipeg, Man.
Tenders will be received by the chairman of the Greater Winnipeg Water District, 901 Boyd Bldg., until noon September 19th, for the construction of 85 miles concrete aqueduct in 5 sections of approximate equal length. A deposit of $100 will be required for plans and specifications.

Winnipeg, St. James, Man.
The municipal engineer has been instructed to prepare plans and estimates for the construction of sewerage and water systems. The approximate cost of the project is $500,000.

CONTRACTS AWARDED

Barton Twp., Ont.
The contract for the construction of sidewalks has been awarded by the township council to Chas. Brayley, 199 Gibson Ave., Hamilton.

Cayuga, Ont.
The city council has awarded to Curran & Clement, of Orillia, the contract for the construction of approximately 5,500 square yards of cement pavement on King and Ouse streets.

Cranbrook, B.C.
A contract has been awarded by the city council to J. B. Turney & Co., of Lethbridge, Alta., for the supply of 5,000 tons of steel pipe, at $43,000.

Hamilton, Ont.
The city council has awarded the following sewer contracts: J. D. Armstrong, of 138 Erie Ave.; Ellis St., $2,400; Campbell Ave., $297; Cambridge, $893. H. Hartung, of 252 East Avenue, N.:Macauley St., $196. City Engineer, Burris Street, $280.

(Continued on page 83)

Tenders and For Sale Department

Notice to Contractors

Billings Bridge

Sealed tenders addressed to the Secretary of the Board of Control, City Hall, Ottawa, will be received up to 4 p.m., **July 28th, 1914**, endorsed "Tender for the construction of four piers and two abutments of plain concrete, being substructure of Billings Bridge."

Any tender deceived after the above stated time will be declared informal.

Plans, specifications and full particulars may be obtained at the office of the City Engineer, on a deposit of $5, same being returnable when plans are returned in good condition to the City Engineer's Department.

Alternative designs, accompanied by working drawings may be submitted. Tenders must, however, be submitted on the design made by the City Engineer's department.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,
City Engineer.
Ottawa, July 8th, 1914. 28-29

Sealed tenders addressed to the undersigned and endorsed "Tender for Repairs to Eastern Pier at Newcastle, Ont.," will be received at this office until 4 p.m. on **Monday, August 10, 1914**, for the construction of Repairs to Eastern Pier at Newcastle, Durham County, Ontario.

Plans and forms of contract can be seen and specification and forms of tender obtained at this Department and at the office of the District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Pastmasters at Kingston, Ont., and Newcastle, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE:—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20, made payable to the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 10, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—64231. 28-29

Concrete Sidewalks

Tenders addressed to Village Clerk, Bobcaygeon, Ont., will be received till noon, **August 4th**, for the construction of Cement Sidewalks, about 6,000 lineal feet, or 24,000 square feet, more or less. Lowest or any tender not necessarily accepted.

29-30

TOWN OF CANORA

Province of Saskatchewan

Sealed tenders will be received by the undersigned, Secretary-Treasurer of the Town of Canora, until **Tuesday evening, 8 o'clock p.m., August 18th, 1914**, for the following works:—

Contract A—Laying Cast Iron Water Mains.

Contract B—Construction of Pump House.

Contract C—

1. Construction of Steel Water Tower.
2. Construction of Concrete Foundation.

Contract D.—Furnishing of Cost Iron Pipe and
3. Housing of Water Tower.
Specials.

Contract E—Furnishing Fire Hydrants and Valves.

Contract G—Furnishing and Erecting Pumping Machinery.

Plans and Specifications may be seen at the offices of the Engineers, Toronto and Winnipeg, or at the Town Hall, Canora, Sask., on and after July 24th, 1914.

The lowest or any tender not necessarily accepted.

S. KORBIN, Mayor.
H. M. SUTHERLAND, Sec.-Treas.
CHIPMAN & POWER, Engineers,
29-30 Toronto and Winnipeg.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Drill Hall, Ingersoll, Ont.," will be received at this office until 4 p.m. on **Thursday, August 6, 1914**, for the construction of the aforesaid building.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., on application to the Caretaker, of the Post Office, Ingersoll, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 14, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—64377. 29-30

TENDERS

Township of Bertie Street or Road

Sealed tenders addressed to the undersigned and marked "Tender for Street" will be received until 2 p.m. on **Friday, July 31, 1914**, for the construction of about one and one-half miles of street or road known as the "Erie Road Extension," to be constructed of water-bound macadam, concrete, rocmac, or tarvia, etc. Plans and specifications, etc., may be seen at the clerk's office, Ridgeway. A marked cheque for 5 per cent. of the amount of the tender must accompany each tender.

The lowest or any tender not necessarily accepted.

M. S. POUND, Clerk.
Dated July 15th, 1914. 29-30

Tenders for Concrete Sidewalks

Sealed tenders, marked "Tenders for Sidewalks," will be received by the undersigned up to three o'clock p.m. of **Saturday, the Eighth day of August, A.D. 1914**, for the construction of about four thousand lineal feet of concrete sidewalks in the Village of L'Orignal.

Plans and specifications may be seen at the office of the undersigned at L'Orignal, Ontario.

Every tender must be accompanied with an accepted cheque for $200, which will be forfeited in case the tenderer fails to enter into a proper contract (with sureties if required) within ten days after being notified of the acceptance of his tender. Where tender is not accepted, cheque will be returned as soon as contract is awarded.

The lowest or any tender not necessarily accepted.

Dated at L'Orignal this 20th day of July, A.D. 1914.

COLIN G. O'Brian,
29-30-31 Village Clerk.

Tenders for the Construction of Danforth Ave. Civic Car Barns

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Tuesday, August 4th, 1914**, as follows:—

For the complete construction (except structural steel and heating plant) of the Danforth Avenue Civic Car Barns.

Specification and tender form may be obtained upon application at the office of the Railway & Bridge Section, Department of Works, City Hall, Toronto.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto,
July 20th, 1914. 29

Tenders for Construction of Sidewalks

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Tuesday, August 4th, 1914**, for the construction of Concrete Sidewalks on Barrie Avenue, Robina Avenue, and Holland Park Avenue, in the Township of York.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.
Toronto, July 21st, 1914. 29

Tender for Construction of Sewers

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Tuesday, August 4th, 1914**, for the construction of Sewers on Glenholme Avenue and Earnscliffe Road, in the Township of York.

Plans and specifications may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER.
Township Engineer.
Toronto, July 21st, 1914. 29

Sealed tenders addressed to the undersigned, and endorsed "Tender for Steel Gates for Regulating Dam, French River, Ont.," will be received at this office until 4 p.m. on **Monday, August 10, 1914**, for the construction of Steel Gates, Towers and Operating machinery for the Regulating Dam, Big Chaudiere Falls, French River, Ont.

Plans and form of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, and Shaughnessy Building, Montreal.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE:—Blue Prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 10, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—59123—28-29.

Machinery and Materials

Sealed tenders, registered and endorsed on the envelope, tender for (tender bidden on) and addressed to H. H. Elliott, M.D., Secretary-Treasurer of the Town of The Pas, will be received up to 6 p.m., **August 11, 1914**, for the supply and delivery of the following machinery and materials.

Tender "A"—For the supply and delivery of two Sewage Lift Pumps.

Tender "B"—For the supply and delivery of Electric House Meters.

Tender "C"—For the construction of Sewage Lift Chamber and Oil Tank Chamber.

A marked cheque for five per cent. (5 p.c.) of the amount of the tender must accompany each bid. The lowest or any tender not necessarily accepted.

Plans and specifications may be seen at the offices of the Consulting Engineers, Saskatoon, Sask.; the Resident Engineer, The Pas, Man.; Contract Record, Toronto, Winnipeg and Montreal, or a complete set of plans and specifications will be given or forwarded on deposit of $25 and a set covering all contracts on a deposit of $50, which deposit will be returned on receipt of a bonified tender and return of specifications. Specifications on Honse Meters to be obtained from the Saskatoon Office, only, without charge.

H. H. ELLIOTT, Secretary-Treasurer,
The Pas, Man.

MURPHY & UNDERWOOD,
Consulting Engineers,
28-29-30-31 Saskatoon, Sask.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Section 2 of the Jetty at Steveston, B.C.," will be received at this office until 4 p.m. on **Tuesday, August 11, 1914**, for the construction of Section 2 of the Jetty at Steveston, at Mouth of the Fraser River, B.C.

Plans and form of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, at New Westminster, B.C.; Victoria, B. C., and on application to the Postmaster at Steveston, B.C.

Persons tendering are notified that tenders will not be considered unless made on the printed form supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE:—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $50.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 6, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—56586. 28-29

Positions Wanted

ARCHITECT.—Excellent recommendations as designer, draughtsman, and perspective artist. Reinforced concrete and steel specialist. Address 6 Kinkora Avenue, off MacKay, Montreal. 28-29

Architectural draughtsman (Scotsman), 12 years American and Canadian experience, seeks engagement. Good man on working drawings and detail. First class references. Box 54, Contract Record, Toronto. 29-30

To Civil Engineers and Contractors.—Technical graduate, age 28, single, experienced in railroad and general construction. First class draughtsman and instrument man, desires position. Apply Engineer, care Contract Record, 119 Board of Trade Bldg., Montreal. 29-30-31-32

CONTRACTORS—Advertiser wants position as blacksmith. Is also expert with steam or gasoline engines and general plant repairs. Now employed but wishes change to more active work. Apply Box 51, 119 Board of Trade Bldg., Montreal. 29-30

AGENTS

Selling building specialties are invited to correspond with the McCrum-Howell Company of Canada, Limited, manufacturers of "Richmond" Vacuum Cleaner Plants. Representatives are required for Winnipeg, Ottawa, Toronto, Hamilton, London, Halifax, N.S., and St. John, N.B. 29

Waterworks, Sewerage and Roadways

(Continued from page 81)

Montreal, Que., Outremont

The following contracts for the construction of sewers and cement sidewalks have been awarded by the town council. Dekeyser Boismans & Co., 1229 St. Valier St., sewers, $3,179.58; C. J. Dryden Co., Ltd., 1215 Green Ave., sidewalks at 21c and 27c per ft.

Peterboro, Ont.

The following contracts have been awarded by the city council. Warren Bituminous Paving Co., of 103 Bay St., Toronto, 10,000 sq. yds. bitulithic pavement, $28,000; Foley & Gleeson, of Central Chmbrs., Ottawa, 20,000 sq. yds. asphaltic concrete pavement, $56,000.

Portage la Prairie, Man.

The city council has awarded the following contracts. Dominion Bridge Co., Ltd., Canada Bldg., Winnipeg, for the erection of galleries, steel water tower and excavation for same, $8,700; C. G. Carr, concrete foundation for the galleries, $3,250. The council are asking for new tenders for the foundations for the water tower. The town clerk is W. R. Grier.

Regina, Sask.

The following contracts for the supply of sewer pipe have been awarded by the city council. MacKenzie-Hazel Co., Ltd., Miklezoro Block, 6, 8, 9, 10, 12 and

15-in. sewer pipe, at $24,750; Peart Bros. Hardware Co., Dewdney St., 18-in. and 20-in., at $3,187.50; Canadian Lock Joint Pipe Co., Ltd., 7th Ave. and Toronto St., 24-in. to 60-in., at $34,126.75.

Sherbrooke, Que.

The contract for grading and macadamizing King Hill and street has been secured by L. A. Ott & Co., of 10 Cathcart St., Montreal, at $61,979.

Welland, Ont.

The contract for the laying of creosote wooden block pavement on north main street has been secured by the Canadian Creosote Block Co., 1 King St. E., Toronto.

Railroads, Bridges and Wharves

Fort William, Ont.

The McKellar River dredging contract has been awarded to the Great Lakes Dredging Company, of 24 Water St. S., Port Arthur.

Grosse Isle, Que.

Tenders will be received by R. C. Desrochers, Secretary to the Public Works Department, Ottawa, until 4 p.m. August 10th, for extension to eastern wharf, Grosse Isle, Quarantine Station. Plans, etc., are at office of the District Engineers, Shaughnessy Bldg., Montreal, Post Office Bldg., Quebec and Montmagny, Que., and at the Dept., Ottawa. The work consists of the construction of a close-faced stone, filled timber cribwork, 126 ft. long by 50 ft. wide.

Newcastle, Ont.

Tenders will be received by R. C. Desrochers, secretary to the Public Works Department, until 4 p.m. August 10th, for the construction of repairs to the Eastern pier. Plans, etc., are at the office of the Dist. Engr., Confed. Life Bldg., Toronto, Postmasters at Kingston and Newcastle, Ont., and at the Dept., Ottawa. The work consists of the removal of portions of the old structure, dredging of site, construction of wooden stone-filled crib, 110 ft. long by 36 ft. wide, together with walings, nigger heads, etc.

New Glasgow, N.S.

The tenders for the construction of the bridge are now in, but the contract is not yet awarded.

North West Cove, N.S.

Tenders for the construction of Tancook Island breakwater will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 12th. Plans, etc., are at the offices of the Dist. Engrs., Halifax, N.S., and Antigonish, N.S., with the Postmaster, North West Cove, and at Dept., Ottawa. The work includes the removal of old pile-work and of old cribwork, the building of a breakwater 260 ft. long by 25 ft. wide, with an ell 200 ft. long by 20 ft. wide.

North Vancouver, B.C.

The Pacific Great Eastern Railway Company proposes to erect stations on Fell and Pemberton Avenues.

Ottawa, Ont.

Tenders for the construction of "Billings" bridge close with the secretary, Board of control, 4 p.m., July 28th. (1) construction of four piers and two abutments of plain concrete; (2) Tender for steel work. Plans and specifications are at the office of the city engineer.

Tenders for the construction of Bank street bridge will be received by the secretary to the Board of Control until July 28th.

Tenders will be received by R. C. Desrochers, secretary to the Public Works, Department, Ottawa, until 4 p.m. August 10th, for the construction of steel gates, towers and operating machinery for the Regulating Dam, Big Chaudiere Falls, French River, Ont. Plans, etc., are at the offices of Dist. Engrs., Confed. Life Bldg., Toronto, Shaughnessy Bldg., Montreal, and at the Dept., Ottawa.

Port Hope, Ont.

Tomkins & Cunningham, of Ottawa, have secured the contract for the construction of improvements to the harbor.

Port Arthur, Ont.

It is understood that the Paquette Dam on Current River and the storage dam at Hazelwood Lake may be prepaired or new ones built.

St. Stephens, N.B.

The Can. Pacific Railway Co. has filed plans for the construction of a wharf on St. Croix River.

St. Michel, Que.

Tenders will be received by Louis Veronneau, secretary-treasurer to the municipal council, until July 31st, for the construction of a pony truss bridge of riveted steel, of a single arch of 50 ft. opening free between pillars. Also for two concrete abutments and approaches on River David.

Woodstock, Ont.

The county authorities have awarded the following contracts on the construction of Fry's bridge over Horner's Creek: general contract for construction, Hamilton Bridge Works, Limited, Bay St. N., Hamilton; abutments, Stauffer & Zinkan.

CONTRACTS AWARDED

Brantford Twp., Ont.

Geo. Thompson, of Brantford, has secured the contract for the construction of a reinforced concrete bridge on St. George road.

Carnduff, Sask.

The Provincial Government Board of Highway Commissions has awarded to Wm. Lee, of 2164 Scarth street, Regina, the contract for the construction of two reinforced concrete abutments for a bridge over S. Antler Creek, E. of Sec. 6, Twp. 3, Range 22, West 1st Meridian.

London, Ont.

The following additional contracts have been let by the London & Port Stanley Rly. Co. Iron culverts, Allis-Chalmers-Bullock, Ltd., 162 St. Antoine St., Montreal; switch timber, W. J. MacBeth, 60 Brock Ave., Toronto.

Peterboro, Ont.

The contract for the 3rd section of the Trent Canal, Severn division, has been secured by Randolph MacDonald, Ltd., of Toronto. The figure is $901,141.

Sherbrooke, Que.

MacKinnon, Holmes & Co., of Drummond Rd., have been successful in obtaining the contract for the construction of the Aylmer bridge.

Public Buildings, Churches, Schools, etc.

Calgary, Alta.

The city has granted to the Western Mausoleum Co., of Winnipeg, a site in the cemetery for the erection of a mausoleum. The building will be of reinforced concrete, with stone facings. There will be 600 crypts lined with marble.

Chipman, Alta.

Separate tenders will be received by J. J. Wutherick, P. O., Chipman, until July 25th, for the erection of a school building and the installation of plumbing, heating and ventilation.

Fort Frances, Ont.

Plans are being drawn for the erection of a public library, at an estimated cost of $8,500. Tenders will be received by the secretary, Mr. J. R. Harris, until August 5th.

Fort William, Ont.

Tenders for the erection of the registry office on May street will shortly be called by R. C. Desrochers, secretary to the Public Works Department, Ottawa. The estimated cost is $22,000.

Guelph, Ont.

Plans for the erection of a college building for the Jesuit Noviciate, are being drawn by W. A. Mahoney, Telephone Bldg., who will receive tenders from July 28th to August 11th.

Hamilton, Ont.

The city council has passed a by-law calling for the expenditure of $50,000 on the erection of a public library in the East End. The proposal will be submitted to the ratepayers on August 12th.

Hamilton, Ont., Dundas

A by-law to raise the sum of $9,000 for the erection and equipping of a high school is to be submitted to the ratepayers.

Hanover, Ont.

Tenders for the erection of a drill hall will be received by Mr. Eugene Fiset, Department of Militia and Defence, Ottawa, until August 3rd. Plans are at the office of the 2nd Military District, 215 Simcoe Street, Toronto; the office of the town clerk; and at the department, Ottawa.

High River, Alta.

Tenders for the erection of a public building will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 11th. Plans, etc., are at the office of Mr. Leo. Dowler, architect, Calgary, Post Offices, Brandon, Man., and High River, at Dept., Ottawa.

Ingersoll, Ont.

Tenders for the erection of a drill hall will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 6th. Plans, etc., are at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, with caretaker of Post Office, Ingersoll, and at the Dept., Ottawa.

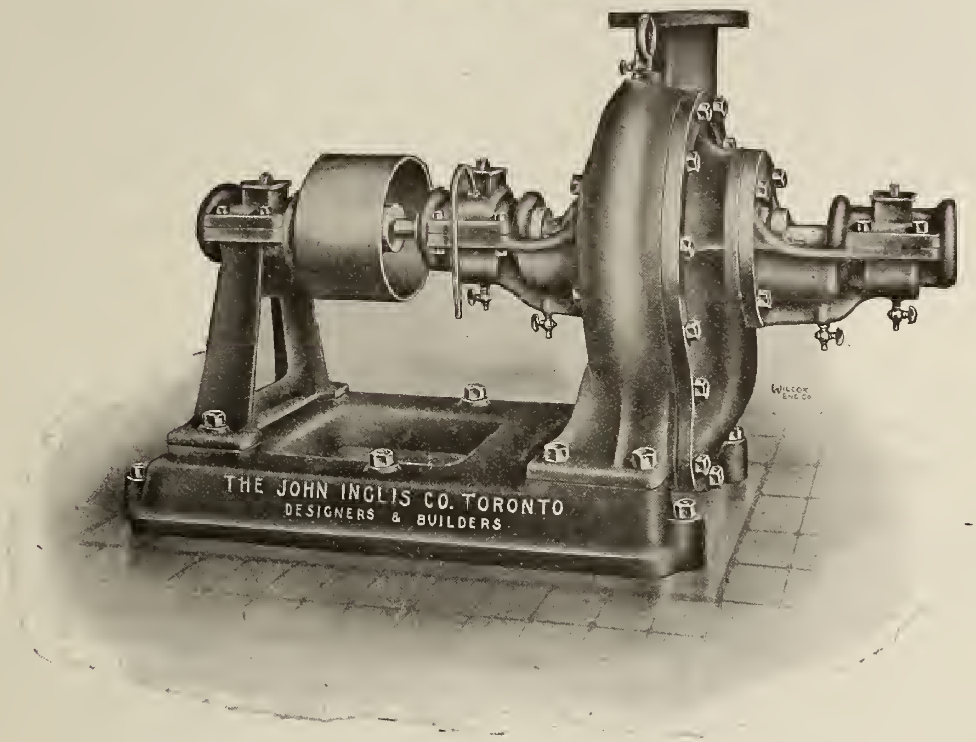
Lacombe, Alta.

The erection of a post office is being considered by the Public Works Department.

Lindsay, Ont.

The town council has decided, on ac-

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

count of extra expenditures on roads and bridges, not to take any action in regard to the proposed isolation hospital this year.

London, Ont.
The Board of Education has decided not to proceed with the alterations at Princess Avenue school, but will build a new school on the MacBeth property to take the place of the building under notice.

Louisville, Que.
Tenders for fitting the interior of the post office will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. July 29th. Plans, etc., are at the office of Mr. P. A. Mousseau, Clerk of Works, Louisville, R. L. Deschamps, Overseer, Montreal Central Post Office, and at Dept., Ottawa.

Midland, Ont.
New tenders for all trades in connection with the erection of a school building will be received by the secretary to the School Board, Mr. C. D. Trueman, King street.

Montreal, Que.
The contract for the erection of the Nurses' Home on Charron St., has been awarded to A. F. Byers, 340 University St., who will call for sub-tenders shortly.

Tenders for the erection of a club house on Dufferin and Logan streets are invited by the architect, J. A. Ouellet, Dandurand Bldg. The building is to be of 4 storeys, solid brick construction, and is expected to cost about $50,000.

Plans are being drawn by A. Piche, 33 Belmont street, for the erection of a public bath in St. George's Ward. Tenders will be called by the secretary to the Board of Control in about two weeks.

Montreal, Que., Lachine
Plans are being drawn for the erection of three fire stations. The architects are Messrs. Dalbe Viau, 76 St. Gabriel St., Montreal; Tetley & Doggart, 78 Crescent street, Montreal, and Benoit & Girard, Southam Bldg., Montreal.

Montreal, Que., Westmount
The plans for the Dominion Square Methodist Church are being altered. The architect, Mr. H. Barr, 23 Guy Block, Montreal, expects to call for tenders during September.

Moose Jaw, Sask.
The city council has decided to postpone indefinitely the erection of the proposed new police station.

Niagara Falls, Ont.
Bulk or separate tenders for the erection of the Morrison St. Methodist Church. will be received by the architects, Bond & Smith, 15 Wilton Ave., Toronto, until July 25th.

North Battleford, Sask.
The Seventh Day Adventists are considering the erection of a school during this year.

Omemee, Ont.
The rebuilding of the armory is proposed by the Public Works Department.

Ottawa, Ont.
The Peter Lyall & Sons Construction Company, of Montreal, has secured the contract for the erection of the Custom's House on Sussex Street. The figure is $1,173,000.

Powassan, Ont.
Tenders for the erection of a drill hall will be received by Mr. Eugene Fiset, Dom. Govt. Dept. Militia & Defence, Ottawa, until July 24th. Plans are at the office of the 2nd Militia Dist., 215 Simcoe St., Toronto, and at the Dept., Ottawa.

Regina, Sask.
The erection of the Governor's residence on Broad street has been postponed until next spring.

Sackville, N.B.
Tenders are now being received by Mr. J. W. Doull, architect to the school board for additions to and the remodelling of two school buildings.

Toronto, Ont.
Tenders for painting and glazing at the Isolation Hospital will be received by the chairman of the Board of Health, H. A. Rowland, until August 4th.

The Board of Education has secured a site on Carlaw Avenue, and plans will be prepared for a $200,000 building.

Tenders for additions to Huron St. school close with the secretary of the Board of Education on July 27th.

Tenders for additions to Pape Ave. Baptist Church are in, contracts will be let shortly.

Tenders for the erection of a 9-room addition to Withrow Avenue school close with the Board of Education on July 27th.

The street cleaning department have secured a permit for the erection of a refuse incinerator on Strachan Avenue. A temporary plant is being installed.

Union Bay, B.C.
Tenders for the erection of an immigration shed and customs examining warehouse, will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 7th. Plans, etc., are at office of Mr. Wm. Henderson, Res. Arch., Victoria, Post Office, Union Bay, and at the Dept., Ottawa.

Winnipeg, Man., St. James
Plans for the erection of a $40,000 school are being drawn for the Rural Municipality of Assiniboia, by Alex. Melville, Builders' Exchange, Winnipeg. The council has passed the necessary by-law.

Yorkton, Sask.
The board of trade has forwarded a resolution to the Public Works Department, Ottawa, requesting them to erect a combined drill hall and armory at Yorkton.

Tenders will be called for a site for the erection of a skating rink and, when secured, a by-law will be submitted to the ratepayers. The estimated cost of the project is $25,000.

CONTRACTS AWARDED

Calgary, Alta.
The city council has awarded to the City Constr. Dept., City Hall, the contract for the erection of the children's shelter on Harvetta Heights.

Cookstown, Ont.
The contract for the erection of a school building has been awarded by the School Board to Wm. Robinson, of this town. Tenders are now being received for steam heating and ventilating.

Elfros, Sask.
The school contract has been secured by Ritchie & Walters, of Yorkton. The contract for heating will be let shortly.

Grosse Island, Que.
The contract for the erection of the Detention Building has been awarded to the P. Lyall & Sons Construction Co., Ltd., of Montreal.

Hamilton, Ont.
The following contracts have been awarded in connection with the alterations and additions to the Barton Street Hospital: masonry, W. H. Yeates, 18 Leeming St., Jr., $46,337; carpentry, T. J. Drake, Beulah Ave., $7,977.

Hampton, N.B.
The Methodist Church Board of Trustees has awarded the contract for the erection of the Sunday School building to Wm. Langstroth, of this town.

Halifax, N.S.
The following contracts have been awarded by the Public Works Department in connection with the alterations to the hospital. General contractors, S. M. Brookfield, Ltd., 58 Granville St.; plumbing, heating and electrical, Farquhar Bros., Ltd., 16 Barrinton St.; painting, D. Roche, Argyle and Jacobs streets.

Hamilton, Ont.
The following contracts have been awarded on the additions to "Ryerson" school. Mason, W. H. Yeates, Jr., 18 Leeming St.; carpentry, Jas. McNeil, 185 Hess St. S.; roofing, J. E. Riddell & Son, Ferguson Ave. N.; heating and plumbing, A. Clark, 7 Main St. W.

Joliette, Que.
The contract for alterations to the post office has been let to the local firm of Jos. Archambault & Co.

Kuper Island, B.C.
The Dept. of Indian Affairs has awarded to the Island Bldg. & Constr. Co., of Duncan, B.C., the contract for the erection of an Indian School.

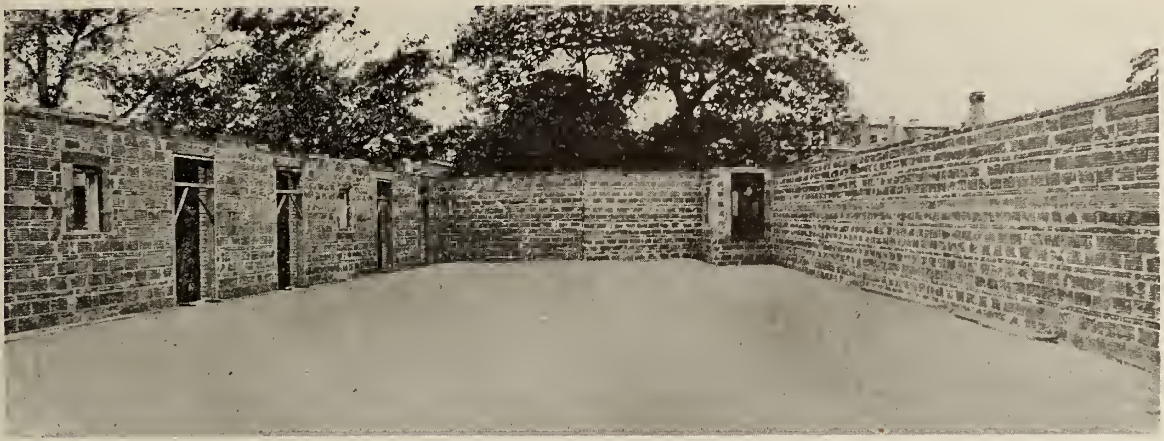
London, Ont.
The following sub-contracts have been awarded on the erection of Tecumseh Avenue school. Carpentry, S. Willis, Talbot and Oxford Sts.; plumbing, Noble & Rich, Queens Ave.

The following sub-contracts have been let on the additions to Dufferin Avenue collegiate. Brick work, Scott Murray, 591 King St.; plastering, W. Scott & Son, 23 Elmwood Ave.; electrical work, Commercial Elec. Co., Richmond St.; painting, Colerick Bros., 212 Dundas St.; plumbing, Noble & Rich, Queens Avenue.

Medicine Hat, Alta.
The contract for the erection of the primary school on Montreal street has been secured by the local firm of Horton & Willits, at $33,597.

Montreal, Que.
W. H. Wardwell, M. E., Contracting Engineer, has obtained a contract for the design and construction of the reinforced concrete structure for the School for the Blind. Wright & Son, architects.

The following contracts have been



Apartment House at 392 Sherbourne Street for Plewes & Storey.
Wm. Fraser, Architect Chas. Nobes, Masonry Contractor

Walls Built with

Denison Interlocking Hollow Tile

and four inches of face brick.

The above cut shows the North West wing, first storey.

Notice the jamb and corner construction, the lintels and horizontal scoring. No furring or strapping required.

Simplicity is the keynote of rapid and good construction.

Write or phone for full information.

Sun Brick Company, Limited

Traders Bank Building

Nights, College 4466, Gerrard 1651 **Main 2935**

awarded in connection with the erection of St. Patricks Parish Hall. General contractors, Jno. Quinlan & Co., 4412 St. Catherine W.; heating and plumbing, Thos. O'Connell, 183 Ottawa street.

Montreal, Que., Ville Emard
The contract for the Roman Catholic church has been awarded to H. Tessier, of 642 Parc Lafontaine, Montreal.

North Battleford, Sask.
The Berlin Interior Hardware Construction Co., Ltd., of Berlin, Ont., has secured the contract for fitting the interior of the post office.

Oshawa, Ont.
The W. J. Trick Co., of King St. E., has secured the contract for interior fittings at the post office.

Portage la Prairie, Man.
The Dept. of Indian Affairs has awarded to the Brown Constr. Co., Ltd., of 619 Ave. Block, Portage Ave., Winnipeg, the contract for the erection of a school building .

St. Leon, Que.
Jos. Couture, of Levis, Que., has been successful in securing the contract for extensions to the Parish Church.

Toronto, Ont.
The following contracts for repairs to Jarvis street Unitarian Church, have been let. Carpentry, Wm. Woodley & Sons, 117 Peter St.; painting, G. H. Shackleton, 774½ Yonge St.

The Board of Eduction has awarded the following contracts for painting schools: King Edward, Jas. Taylor, 179 Markham St., $975; Pape Ave., Jas. Taylor, 179 Markham St., $550; Alex. Muir, Jas. Phinnemore, 445 Yonge St., 445; Howard Park, Jas. Phinnemore, 445 Yonge St., $235; Wellesley St., Jas. Phinnemore, 445 Yonge St., $245; York, Jos. R. Bell, 190 Clinton St., $115; Kent, E. W. Vernon, 393 Harbord St., $1,235.

Winnipeg, Man. (Charleswood)
The school contract has been awarded to the Standard Supply & Fuel Company, of 278 Des Meurins St., Norwood.

North Winnipeg, Man.
The contract for the erection of the drill hall on Machray and McGregor streets has been secured by the Brown Construction Co., Ltd., 10 Monadnock Bldg.

Business Buildings and Industrial Plants

Brampton, Ont.
Tenders will be called shortly for the erection of a jam factory for Lindner's Ltd., 340 Dufferin St., Toronto. Architect, Audrey Butler, 104 Main St., Niagara Falls.

Brockville, Ont.
Plans are in progress for alterations to Mr. Jno. McLennan's picture theatre on King St., the present building is to be remodelled for large road shows and high-class vaudeville.

The Jas. Smart Manufacturing Company are about to replace the old frame building, recently burned, with a concrete and steel. Estimated cost $15,000.

Calgary, Alta.
The Public Works Department plans for a departmental building are about completed. It is proposed to afford accommodation for a number of the Dominion departments. The architect is Mr. Leo. Dowler, 17 Alexander Crescent.

Edmonton, Alta.
J. P. Scott, of the McMullen Block, proposes to erect a pottery factory.

Esterhazy, Sask.
The village council has had plans drawn for the erection of a skating and curling rink. The architect is Jno. Rowell, of Wapella.

Hamilton, Ont.
The Proctor-Gamble Company, of Cincinnati, multi-millionaire soap and perfume manufacturers, have decided to build a plant here at a cost of over a quarter of a million dollars.

London, Ont.
Tenders for the additional premises of the "Advertiser" Printing & Publishing Co., Dundas St., are in. The contracts are not yet awarded.

Montreal, Que.
Additions are about to be made to the premises of Jas. Strachan, 246 City Hall Ave., and the architect, Sydney Comber, Green Ave. and St. Catherine W., is now receiving tenders on steel and concrete work. All other tenders will be called separately in about two weeks.

Montreal, Que., Verdun
The building of the stores and residences proposed by Mr. A. Bailie has been postponed.

Moose Jaw, Sask.
The Woolworth Co., of New York and Toronto, are negotiating for the lease of a site and premises on Main and High streets.

Prince Rupert, B.C.
The erection of a four-storey hotel on 3rd Avenue is being considered by Mr. Frank Clapp.

Regina, Sask.
The city council has granted to the R. J. Lecky Co. an extension of 12 months in which to erect the proposed 4-storey warehouse, the site for which was recently granted.

Sackville, N.B.
Tenders for the erection of an opera house will be received by Wm. Wood & Son, until August 4th. The estimated cost is $20,000.

Sudbury, Ont.
Tenders for general contractor and plumbing, heating, and electrical fittings in connection with the erection of business premises and lodge rooms for the I. O. O. F. will be received by the architect, W. H. Owens, of the Baikie Block.

Toronto, Ont.
Bohan Bros., of 43 Adelaide W., contemplate the erection of a new warehouse. A site 145 ft. by 91 ft. has been purchased.

Viren, Man.
A by-law providing for the construction of a skating and curling rink has been passed by the town council, and work on same will start as soon as a site is secured.

Winnipeg, Man.
Fittings Limited, of Oshawa, Ont., have plans in progress for the erection of a warehouse.

Plans are in progress for alterations to an office building on Main and Bannatyne streets. The architects, John D. Atcheson & Co., Trust & Loan Bldg., will call for tenders shortly.

Nothing will be done this year in regard to the proposed crection of a $100,000 office building on Portage and Garry streets by H. B. Orkin.

CONTRACTS AWARDED

Brantford, Ont.
The following contracts have been awarded in connection with the erection of the silk factory. General contractors, masonry, carpentry, steel, roofing, plastering, painting, heating, Bennett & Bowden, 4 Ontario St.; eletcric lighting, boiler, engine, shafting, elevator to be let.

Fort William, Ont.
The contract for the erection of a business block for T. Nault, Simpson St., has been awarded to E. Boisnault.

The contract for the erection of a business block on Victoria St. for Dr. Hamilton has been secured by J. A. Hamilton, Donald St.

London, Ont.
H. Hayman, of 491 Ontario St., has secured the contract for the erection of a moving picture theatre on Dundas St., for Mr. Ed. Bernard.

Montreal, Que.
The contract for alterations to the factory of J. C. Wilson, Ltd., 61 St. Alexander St., has been awarded to Jas. Shearer & Co., Ltd., of 225 St. Patrick Street.

W. H. Wardwell, M.E., Designing Engineer, has received the contract for the design of the reinforced concrete structure for the addition to the bakery of James Strachan. L. R. MontBriand, architect.

Regina, Sask.
The following sub-contracts have been awarded in connection with the erection of an office building for the Saskatchewan Co-operative Elevator Co., Ltd., Leader Bldg., Hamilton St. Electrical, Northwestern Electric Ltd., 107 Kerr Block; interior fittings, Western Mfg. Co., Dewdney and Halifax.

Toronto, Ont.
The contract for the erection of the office building on Adelaide and Toronto streets for the Excelsior Life Assurance Co. has been secured by the P. Lyall Construction Company, of 201 King St. W.

Residences

Lindsay, Ont.
Tenders for the erection of a rectory for St. Paul's English Church will be received by D. Adams, Lindsay, until August 1st. Plans and specifications are at G. A. Milne's tailor shop, Lindsay.

Montreal, Que.
A. F. Byers & Co., 34 University St., who have the contract for two residences for A. W. Powell, are taking tenders now on mill work, plastering, painting, plumbing, roofing, electrical, tile and marble work.

J. H. McDowell, architect, Drummond Bldg., will call tenders shortly on the erection of an apartment house on Mt. Royal Avenue for Parent Bros.

Sale of Quarries, Quarry Plant, Etc.

at Beamsville and Crookston, Ontario

The Trustees of the Estate of the late Honourable William Gibson invite tenders for the purchase of the valuable Quarries situated at Beamsville, 22 miles from Hamilton and 12 miles from St. Catharines, consisting of 94 acres more or less; also at Crookston, 110 miles from Toronto, consisting of 14 acres more or less.

These quarries are those owned by the late Senator Gibson and contain a practically unlimited quantity of the finest limestone and hundreds of thousands of tons of chips suitable for immediate crushing. The Beamsville quarries have a complete tramway system from all parts of it to the G. T. R. Station with valuable franchises, while at Crookston the G. T. R. switch enters the quarry and the C. P. R. is about 500 feet away. Favorable freight rates enable both quarries to compete in the masonry and crushed stone markets of Hamilton, Toronto and Montreal.

Tenders will be received for any or all of the under-mentioned parcels but in the event of parcels 3 or 4 being acquired by tenderers other than the purchasers of the lands the successful tenderers must undertake with the Trustees to remove all the machinery, etc., within three months.

Tenders for parcels 1 and 2 will be considered either on a fixed basis or on a cash payment plus a royalty of so much a cubic yard of stone. The price on a fixed basis will be payable one-third cash, the balance in equal payments at one and two years with interest at six per cent.

Parcel No. 1

Quarry properties at Beamsville owned by deceased with tramway system in connection therewith and being composed of portions of Village lots in Beamsville and of lots in the Township of Clinton in the County of Lincoln, said properties having been conveyed to deceased by deeds registered as Nos. 574 and 304 (Beamsville) 2858, 2509, 2631, 2220, 3558, 2438, 4190, and 5238 (Clinton) and 1259, 1263 and 1268 (Beamsville) with 13 buildings, including office, carpenter and blacksmith shops, engine house, etc. Also three miles of tramway with the existing franchises in connection therewith.

Parcel No. 2

Quarry lands at Crookston containing by admeasurement 14 and 2/100 acres, being composed of part of lot Number Ten in the Ninth Concession of the Township of Huntingdon in the County of Hastings and more particularly described in the conveyance thereof to the said William Gibson dated 21st December, 1896, and registered as No. 5003 (Huntingdon) with all buildings situate thereon.

Parcel No. 3

Plant at Beamsville:
12 hoisting engines with boiler and equipment.
7 power derricks with equipment, masts 65 to 75 ft.
5 pneumatic rock drills.
1 centrifugal pump.
2 Champion road engines.
5 road scrapers.
23 tram cars.
Tools, tool boxes, blocks, pipes, valves, ropes, wires, etc.
16 double drum portable horsepower hoists
4 hand power derricks, masts 18 to 35 feet.
6 blacksmith's forges.
1 sand pump.
1 6 x 16 ft. Blake pattern stone crusher.
3 dump cars.
200 yds. of dressed and partly dressed stone.

Parcel No. 4

Plant at Crookston:
2 dynamos.
1 stationary boiler and equipment.
1 single horizontal steam piston pump.
4 derricks.
1 rock drill.
1 hoisting engine with boiler and equipment.
4 horse-driven hoists with equipment.
Pipe, tools, etc., etc.

Detailed inventories may be seen at the office of Mercantile Trust Company of Canada, Limited, in Hamilton or of Messrs. Jennings & Clute, 906-910 Traders Bank Building, Toronto.

A cheque for $500, payable to the Estate of Hon. William Gibson must accompany each tender. The highest or any tender not necessarily accepted.

The Trustees reserve the right to sell privately the whole or any part at any time.

Dated at Hamilton this 20th day of July, 1914,

For the Trustees

Mercantile Trust Company of Canada, Limited

Montreal, Que., Notre Dame de Grace

Tenders for the erection of 14 residences on Beaconsfield St., are invited by the architect, Chas. Mitchell, 58 Beaver Hall Hill.

Montreal, Que. (Westmount)

Tenders for the erection of an apartment house on Sherbrooke and Oliver streets will be called shortly by the D. J. Spence, 46 Beaver Hall Hill, Montreal.

A permit has been granted to O. Lamareaux, 15 St. James street, for the erection of a large apartment house at the corner of St. Catharine and Glen streets. The architects, Audit & Charbonneau, 364 Dorchester St. W., will call for tenders immediately. The estimated cost is $275,000.

Ottawa, Ont.

The erection of a residence at Sunnyside at an estimated cost of $5,500 is contemplated by Jas. York, of Vernon, Ont.

F. L. Campbell, 219 5th Ave., proposes to erect a residence at an estimated cost of $6,000.

Toronto, Ont.

Plans for the erection of a detached residence on Garden street have been drawn for J. Carroll, of 223 Garden St., who will sublet some contracts.

Tenders on all trades except carpentry and masonry in connection with the erection of two residences on Quebec avenue are invited by Hillman & Hull, 121 Quebec avenue.

Tenders on the erection of a duplex residence on Bloos St. and Quebec Ave. are invited by Geo. Breen, 209 Humberside Ave.

Tenders for the erection of a residence for St. John's Parish close with the architect, A. F. Galea, 1227 Gerrard St. E., July 25th.

Winnipeg, Man. (St. Boniface).

H. Brodeur, 56 Dagmar Street, and G. Goffinet, 16 Aulnan Street, have under consideration the erection of two residences.

CONTRACTS AWARDED

Ottawa, Ont.

The contract for the erection of Miss McNaughton's residence on Leonard street has been let to Geo. Eaman & Son, of Isabella St.

Toronto, Ont.

The Belgo-Canadian Constr. Co., has awarded to the United States Steel Kent Bldg., have secured the contract for the erection of a residence on St. Lawrence Park for Mr. Thomas Mix.

Power Plants, Electricity and Telephones

Fort Fraser, B.C.

The Vanderhoof Power Co., Ltd., B. C. Permanent Loan Bldg., Victoria, B.C., have filed plans for 2 dams, capacity 10,000 acre ft.

London, Ont.

The purchase of rolling stock and an overhead apparatus is proposed by the London & Port Stanley Rly. Co. Specifications are at the office of the engineer, F. A. Gaby, Continental Life Bldg., Toronto.

St. Thomas, Ont.

The city council proposes to install an electric lighting system on Talbot St.

Toronto, Ont.

The Board of Control approved plans for the erection of new car barns on Danforth Avenue. Tenders will be called shortly.

Tenders for the supply of lead covered cable close with the Chairman of Toronto Electric Commrs., at noon July 30th.

A line is being surveyed from the Humber to Milton, running by way of Etobicoke, Toronto and Trafalgar Twps., with a view to the construction on a hydro-radial line.

CONTRACTS AWARDED

Britannia Beach, B.C.

Fraser & Chalmers of Canada, Ltd., of Montreal, have been awarded a contract by the Siemens Company of Canada, Limited, for a 2,000 kw. steam turbine, condensing plant and pumping equipment. This machinery will be installed by the Britannia Mining & Smelting Company, Limited.

Calgary, Alta.

The City Commissioners have awarded to the Canadian General Elec. Co., Ltd., 11th Ave. and 4th St. W., a contract for the supply of two 12,000 volt 3,000 kw. step-down transformers at $383 each.

London, Ont.

The Utilities Commsn. has awarded to the Can. General Electric Co., Ltd., 212 King St. W., Toronto, the contract for the equipment of Horton street substation.

Regina, Sask.

The City Council (Street Rly. Dept.) Products Co., 402 Trust & Loan Bldg., Winnipeg, the contract for the supply of 29 steel poles and pole hardware, at $943.85.

Ricetown, Sask.

The Ricetown Rural Telephone Co., Ltd., has awarded to W. D. Craig, 2276 Cornwall St., Regina, the contract for supplying material and construction of a telephone system.

Saskatoon, Sask.

The Ferranti Electrical Company, of Toronto, have been awarded a contract by the city of Saskatoon, Sask., covering one 600 kw. Peebles' La Cour Converter, and its controlling switchgear. This machine will be operating on traction service, in parallel with the existing motor generator sets.

HILDER DAW
A.M.C.S.C.E., M.R.S.I., M.L.E.S.
SEWERAGE SYSTEMS
Room 202, King's Hall
591 St. Catherine St.W., MONTREAL

Municipalities

and others sending in tender advertisements for the Contract Record are requested to bear in mind that these must be in our hands by

Ten o'clock on Tuesday morning,

each week, in order to be published in the issue of the following day.

MacLean Reports are issued daily (card system) and give accurate and early information on **Canadian** building and engineering projects, contemplated, their progress, and details of the material and equipment required. Rates and sample reports on request.

MacLean Daily Reports Limited
220 King St. West - TORONTO

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5 Floors of This New Building, For Office and Warehouse Use.

Adelaide St. W., Toronto

This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

- Centrally situated
- Light on four sides
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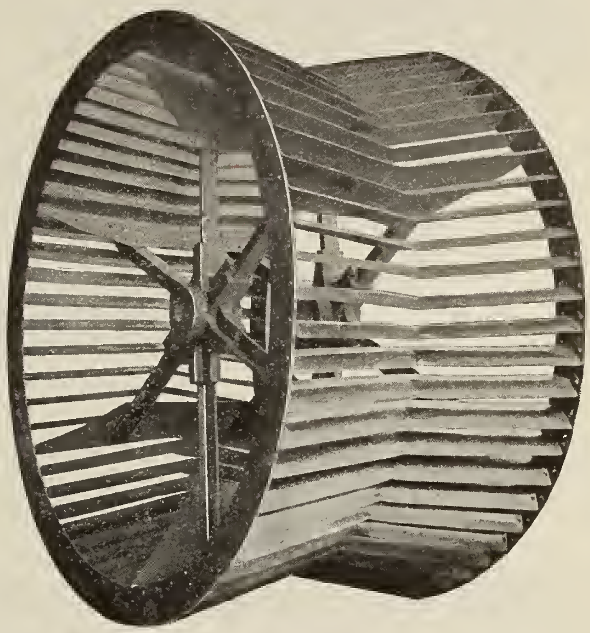
- Vaults
- Low insurance
- One block from four car lines
- Floor area, 6,300 sq. feet, each floor.
- Building ready for occupancy July 25th.

For further particulars ask

R. A. Donald
Union Bank Building - Toronto

Sturtevant
(REG. CAN. PAT. OFF.)

Union "V" Fan



A Fan of exceptionally high efficiency, with large inlet and blade area, and scientifically designed blades and casing.

Every part carefully and rigidly constructed of the best materials obtainable and by a high grade of workmanship.

A Fan that will give continuous satisfactory service at a minimum power consumption.

Built in Canada by the

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Galt, Ontario

Toronto - Montreal - Winnipeg

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by calling on our SERVICE DEPARTMENT, which furnishes Roofing Foremen for inspection of **RU-BER-OID** ROOFING already laid or for supervision of **RU-BER-OID** ROOFING when ready for laying

Free of Cost

Thus ensuring an absolutely waterproof and weatherproof roof covering fully guaranteed by the sole makers of

RU-BER-OID
TRADE MARK REGISTERED
ROOFING

RU-BER-OID is laid on steep or flat roofs, wood or concrete by the single layer or the built-up or reinforced method.

Let us repair or replace your old roofing with this modern type. Estimates on request.

For details write to or call on SERVICE DEPARTMENT

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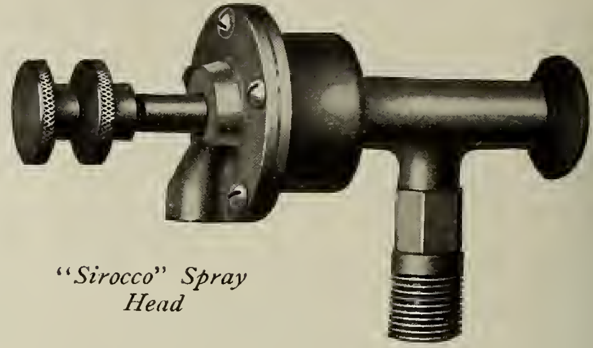
52 Victoria Square, MONTREAL

Exclusive makers in Canada of RU-BER-OID ROOFING, KA-LOR-OID ROOFING, AL-BA-ROID ROOFING. Also Asphalt Roofings, Brands Cronolite, Dominion, Eureka.

MADE IN CANADA



"Sirocco" Spray Head

It's the design and operation of the spray heads that's responsible for the efficiency or inefficiency of an air conditioning system.

"Sirocco"
TRADE MARK.

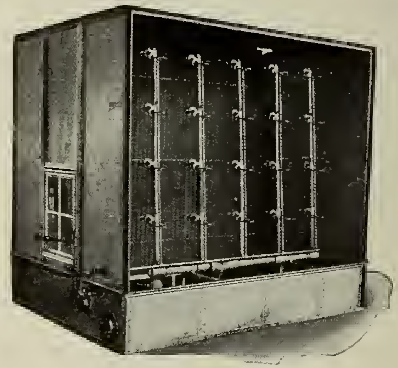
Purifiers, Coolers and Humidifiers

are equipped with spray heads which were designed to overcome the usual "clogging up" trouble. All heads can be flushed simultaneously by slightly turning a three-way cock located on the **outside** of the Purifier.

All heads are adjustable as to density of spray and can be permanently set at any desired point by means of a lock nut.

All heads are made of brass and accurately machined to template.

No packing is used.



Purifier Complete

Architects, Engineers and Contractors are invited to ask us for any information whatsoever regarding the design, construction, operation and application of Sirocco purifiers, Coolers and Humidifiers.

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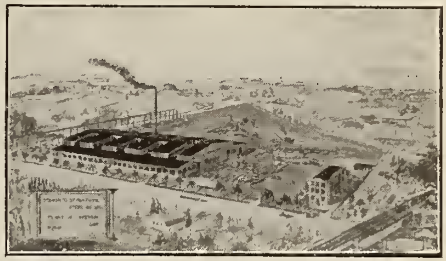
Toronto Plant



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Toronto Structural Steel Company, Limited

Annual Capacity—20,000 Tons

Ask for list of material on hand for immediate delivery

Sales Offices—Atlantic Ave., TORONTO
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TORONTO, ONT. WESTON, ONT.

STRUCTURAL STEEL FOR QUICK DELIVERY

We carry in stock at Montreal, 8,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

Bridges, Roof Trusses, Columns, Girders, Beams, Towers and Tanks, Penstock.

Estimates furnished promptly. Capacity 18,000 Tons Annually.

Structural Steel Co., Ltd.
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STANDARD STEEL CONSTRUCTION CO.
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WELLAND - CANADA
MANUFACTURERS AND ERECTORS
STEEL BUILDINGS AND BRIDGES

This **STONE CRUSHER**
IS THE
Pat. **"ACME"** Reg.
The Machine of
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Goodwin, Barsby & Co., Leicester, Eng.

"AMERICAN"
ENAMELED BRICK
Combine Beauty, Strength and Durability.

Write for Catalog "FIFTH EDITION" illustrating the standard sizes, colors and many of the special shapes.
SAMPLES—miniature or full size, will be forwarded, if desired.
Prompt attention given formal inquiries.

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Sarnia Bridge Company Limited
SARNIA - CANADA
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Beams, Channels, Angles Plate
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All our new code wire is inspected by the Underwriters Laboratories Inc. and have their inspection tags attached.

Stock carried at Toronto, Montreal, Winnipeg and Vancouver.

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The Canadian Bridge Company, Limited
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Railway and Highway Bridges

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Estimates furnished on application.

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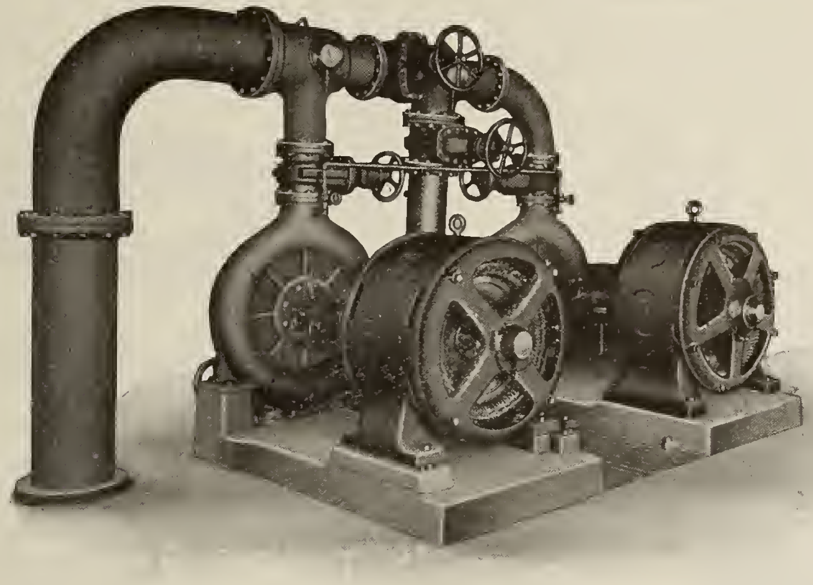

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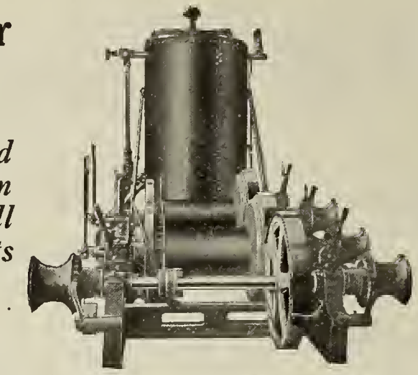

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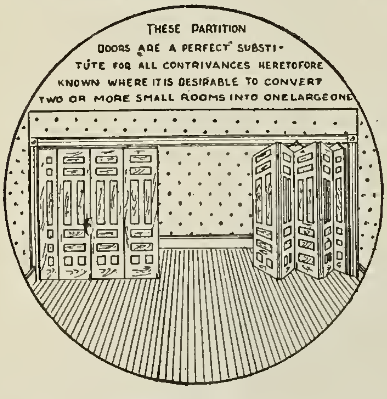
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Springer's

Folding Door and Partition Hanger

is far ahead of all other dividing doors for simplicity of construction, inexpensiveness of material and adaptability.

No track on floor required.

Perfect balance.

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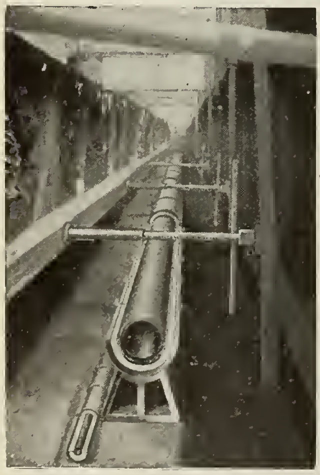

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Its
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Will appeal to you.

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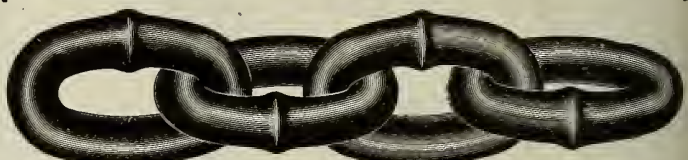

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EQUIP YOUR CELLAR

with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

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With our 9 Branch yards situated as they are we are prepared to guarantee a prompt delivery service of any orders you may favor us with and would ask you to give us a trial in order that we might prove same to you and also prove the excellence of our material.

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**Skylights, Ventilators
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Determine that you will take no more chances on the materials you use. Decide right now that there is but one class of goods which will reflect credit on the work you do.

Some one has said that the best Advertisement a man can have is "Work done well"—we might add "With 'Metallic' Materials."

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Towers and Tanks for all purposes.

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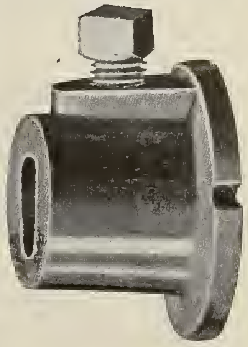
Water supply outfits of every description.

CORRESPONDENCE SOLICITED

Universal Form Clamp



Secured to the ends of round rods passed through your forms, these inexpensive clamps hold the centering rigid, resisting a strain exceeding the tensile strength of the steel rods themselves.

Clamps are easily applied, adjusted and tightened. A wrench releases them. Pull the rods out of the concrete with our Rod Puller.

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Anchor Hardwall Plaster

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Put up in bags ready for immediate use by mixing with water only.

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Screened Sand and Gravel

Largest Producers, Noted for Prompt Shipment.

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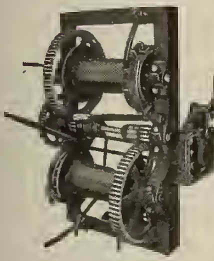
Iron Ore, Pig Iron, Car Wheels, Cast Iron Water and Gas Pipe, Specials, Valves, Hydrants, etc., Castings of all kinds, Mooring Bollards for both Concrete and Wooden Docks, Hoisting Machinery.

STEAM and AIR ENGINES, HOISTING ENGINES, STEAM CRANE HOISTS, MOTOR CRABS, SWINGING ENGINES, DRILL HOISTS, SPUD HOISTS, MARINE MACHINERY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Grand Haven,
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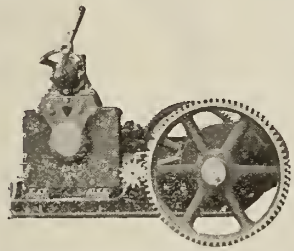
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We are now in a position to offer

"Queenston Blue" Limestone

in Sawn Slabs

as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

The Queenston Quarry Co., Ltd.
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Crushed and Rubble Stone

Our quarry has a capacity of 300 tons per day, and with excellent shipping facilities we can supply your requirements in all sizes of this stone on shortest notice.

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Lime, Sewer Pipe and Fire Brick

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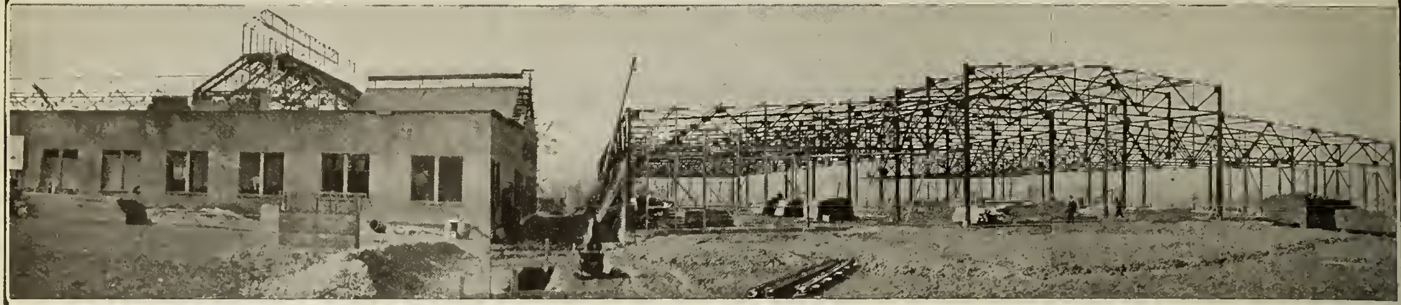

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460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

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Representatives for Canada:
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We have unequalled facilities for making prompt shipments and can guarantee deliveries to date.

Our line of bricks comprises

RED PRESSED BRICK
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RED RUFFESTRY BRICK
FLASHED PRESSED BRICK
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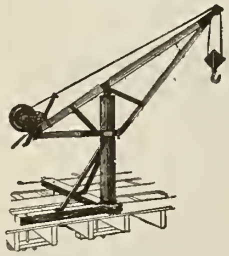
Russell Shale Bricks, Ltd.
RUSSELL, ONT.

Sasgen Derricks



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Our derricks are built of the best crucible steel and malleable iron fittings. They are light, strong and quick in operation and easy to set up or take down. They save money, time and labor.
To a reliable customer we shall be pleased to send any derrick on a three days' trial.

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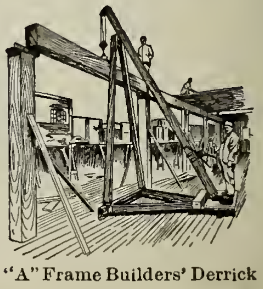

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Neptune Meter Co.

Manufacturers of the well-known

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Water
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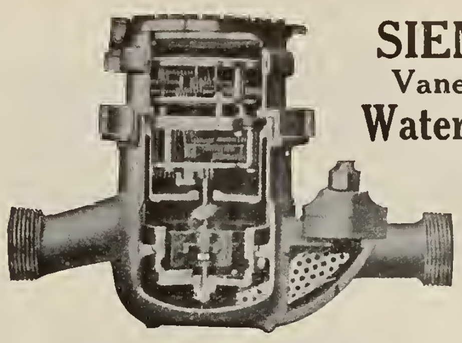

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Vane Wheel
Water Meters

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The Main Advantages:

Simple, solid construction, involving only a few easily interchangeable parts. Best workmanship and accurate adjustment. Large sack-like strainer which has five to ten times the clear cross section of the connecting sockets. This can be taken out without removing meter from pipe. All toothed wheels are cut on special machines, not stamped. Only the best celluloid is used for vane wheels. Meters are fitted with regulating device easily adjusted from outside. Graphite is used for bearings of vane wheel shaft, rendering oiling of bearings unnecessary and is not influenced by water containing salts or acids. Frost proof device.

Siemens have been making water meters for the last fifty years.

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Most Highway Engineers Use the GURLEY Light Mountain Transit

The extreme accuracy of this rigidly constructed, precisely graduated transit, combined with its light weight (about 10¾ pounds), general adaptability, and reasonable price, explains why such large numbers are being sold to satisfied Road Engineers all over the United States and Canada.

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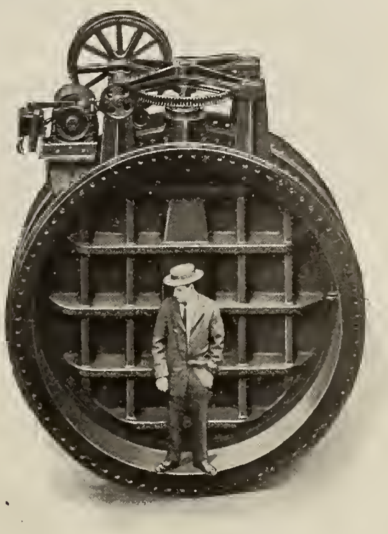

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We make a specialty of designing and executing complete piping contracts. Estimates furnished on receipt of plans and specifications.

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COATED AND WRAPPED

Made in sizes from 2″ to 10″ inside diameter with different thicknesses for varying pressures.

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Three Rivers, Quebec
Wayagamack Pulp and Paper Co., Ltd.

50,000 gallons.	149 feet to top
120,000 "	100 feet to top

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Embodies points of merit that make it worthy of your consideration. Scientifically designed and economically constructed it recommends itself to discriminating architects and engineers.

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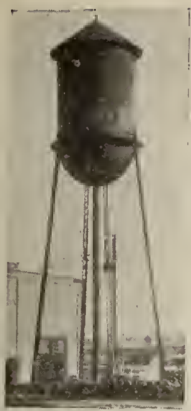

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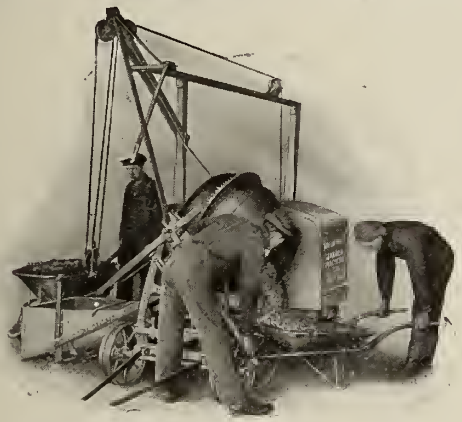
just the Mixer you've been wishing for

The "Big-an-Little"



1914 Model now ready

The small mixer has proved its worth. You know it pays better to have one or more small portable mixers than to mix by hand or to have a great big clumsy mixer. The question has been to get a Dependable Small mixer at a low price.

The "Big-an-Little" is the biggest and best small mixer on Earth, and our Low Prices amaze the Mixer World. They are used everywhere. Write us NOW.

The Jaeger Machine Co.
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Drifting Sand Filters

THIS system has been accepted by the City of Toronto after a thorough test, and a plant having a daily capacity of 60 million imperial gallons is now under construction. The filters can be installed in either the gravity or pressure systems.

Designs and estimates furnished on application.

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Water Filters
1,000 to 1,000,000 Gallons a Day

Refrigerating Machinery
1/4 to 60 Ton Daily Capacity

Water Purifiers
4 Gallons to 5,000 Gallons a Day

Refrigerators and Refrigerating Boxes for Ice or Machine Refrigeration
Hotel, Restaurant and Saloon Equipment and Supplies

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302 McGILL BLDG., MONTREAL, P. Q.

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $17; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11.50 to $12; wire-cut brick for foundation work, $9.50 to $10; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $32; sand-lime brick, $8.60, King Edward siding; $7.50 at the mill; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1,30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots.

Hydrated lime—$11 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 66c per gal. of 9 lbs.

Raw linseed oil—in bbls., 63c per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 69c.

MONTREAL PRICES

CEMENT, LIME AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Enamel Concrete Brick—grey $24, red $24, buff $25, white $47, plain pressed $12 per thousand, all f.o.b. Montreal. Immediate delivery at any time.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15c basis per pound; British manilla, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 65c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 lbs.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

(Continued on page 106)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

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WIRE NAILS and other **WIRE PRODUCTS**

These Service Boxes Will Give You Real Service

Arch or Minneapolis Pattern

And they will give you lots of it and no trouble. You will agree with other water works experts that it is the most sensible box made. It is simply unbeatable as a service box. The Mueller Extension Service Box, because of its superiority, is being widely adopted by Canadian cities.

It is a dirt proof, vandal proof box and we guarantee it unconditionally.

Ask us for prices and descriptive literature.

Made in Sarnia, Canada

H. Mueller Mfg. Co.
Sarnia, Ont.

Makers of high grade Water, Plumbing and Gas Brass Goods.

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from p. 104.)

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.40 per 100 lbs.; square twisted, $2.50 per 100 lbs.; channels, angles, beams and plates, $2.90 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $9.00 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

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Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.75; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25; all less 40 per cent.

SUNDRIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10 per 100 lbs.

Boiled linseed oil—in bbls., 85c per gal. of 9 lbs.

Raw linseed oil—in bbls, 83c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

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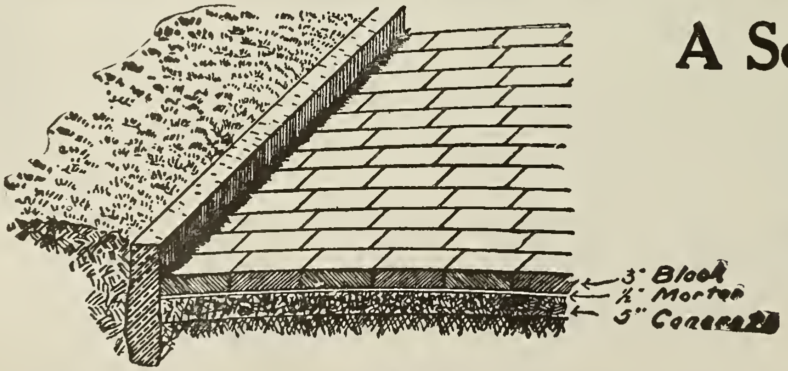

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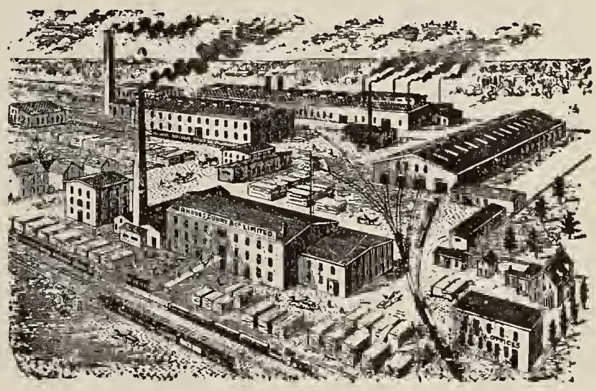

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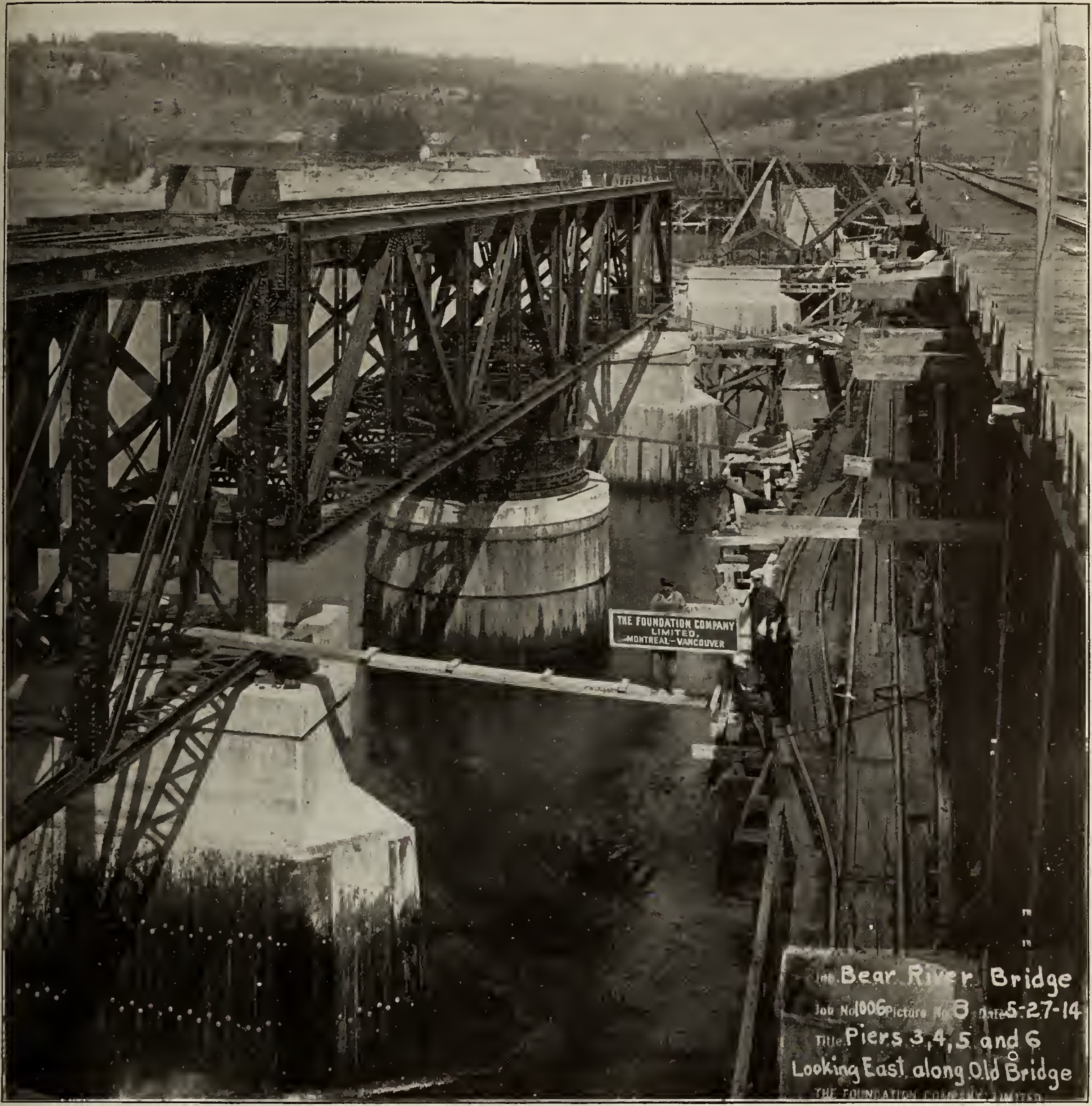
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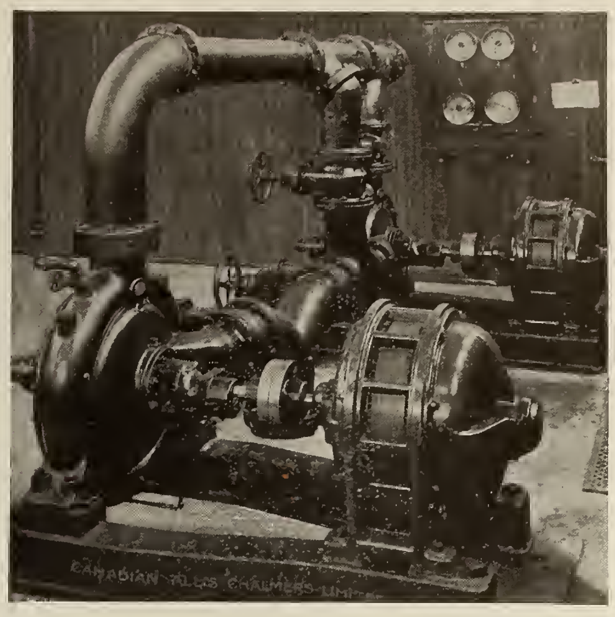

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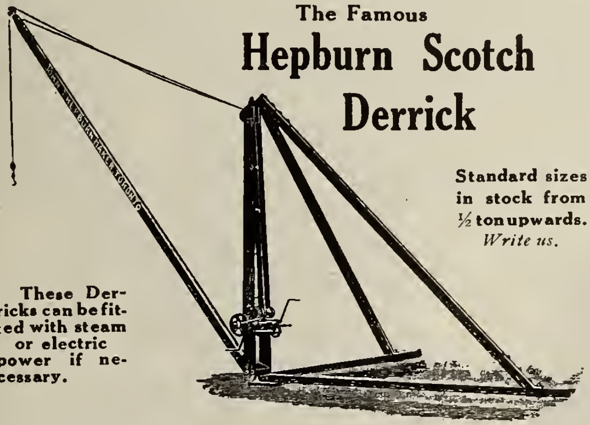

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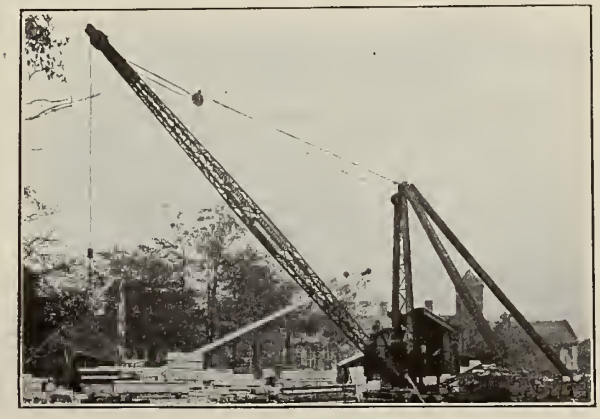

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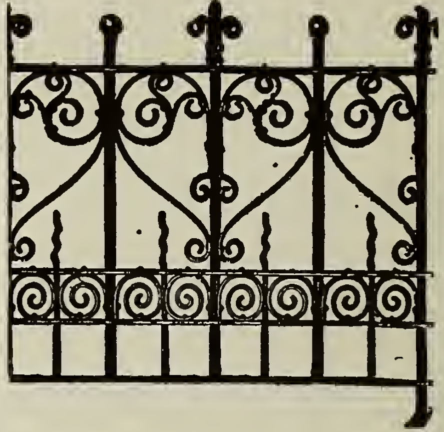

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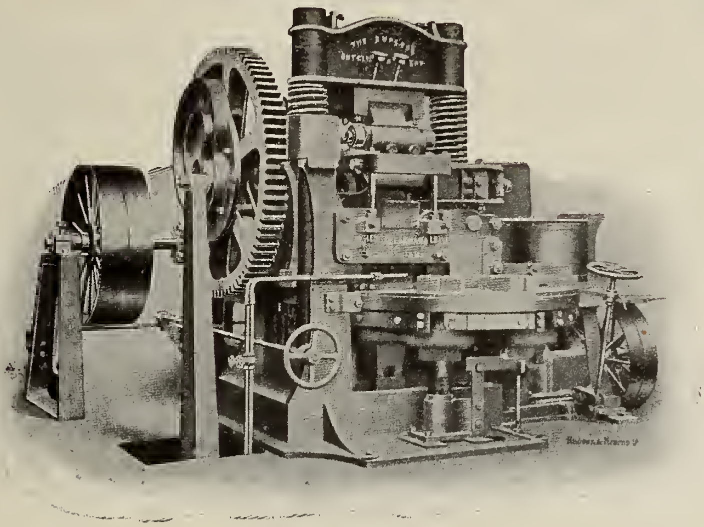

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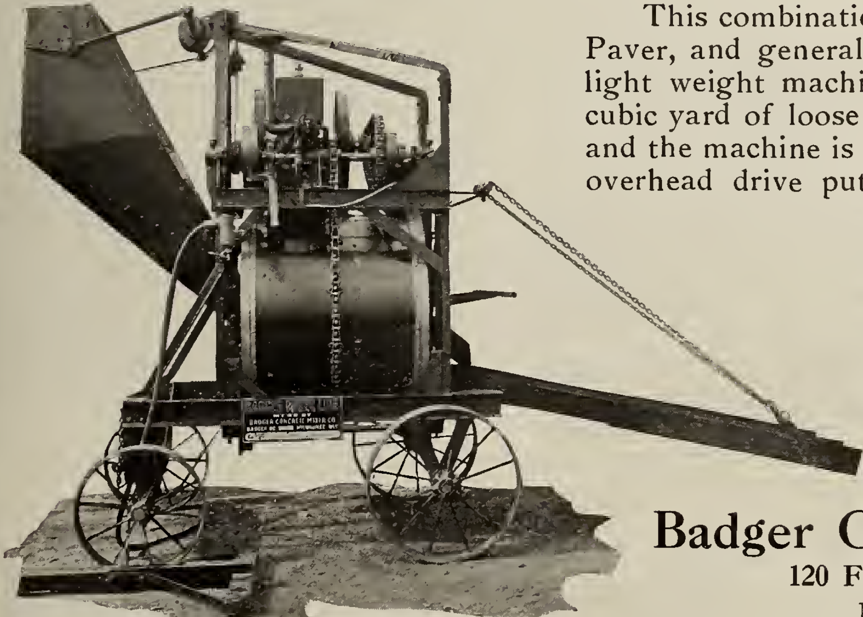

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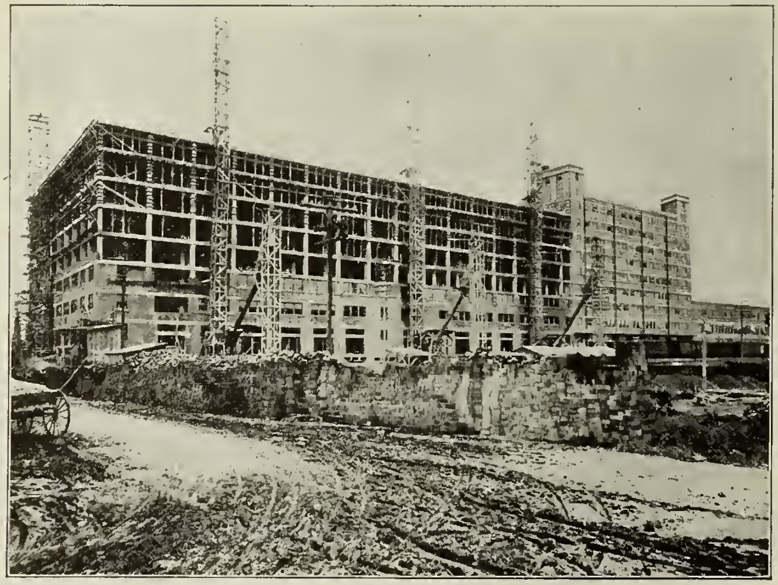

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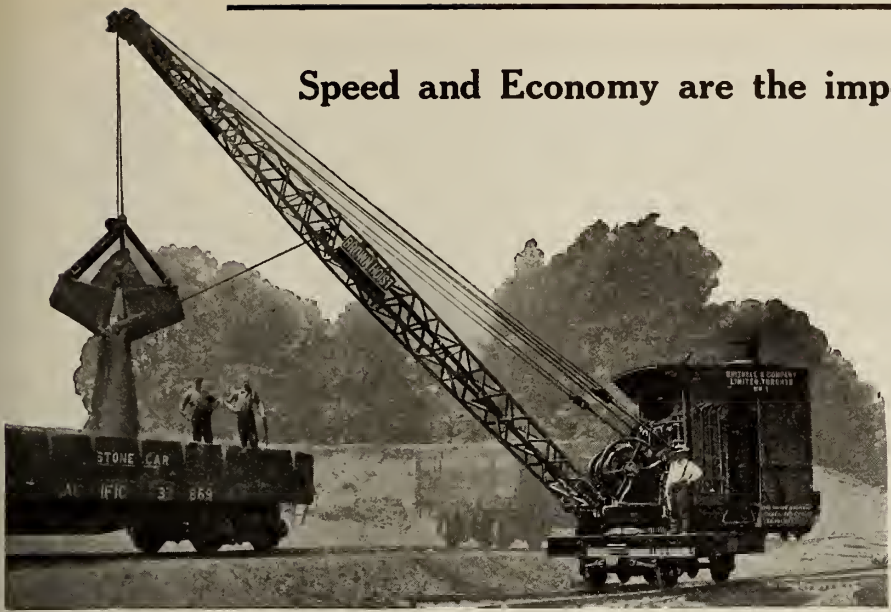

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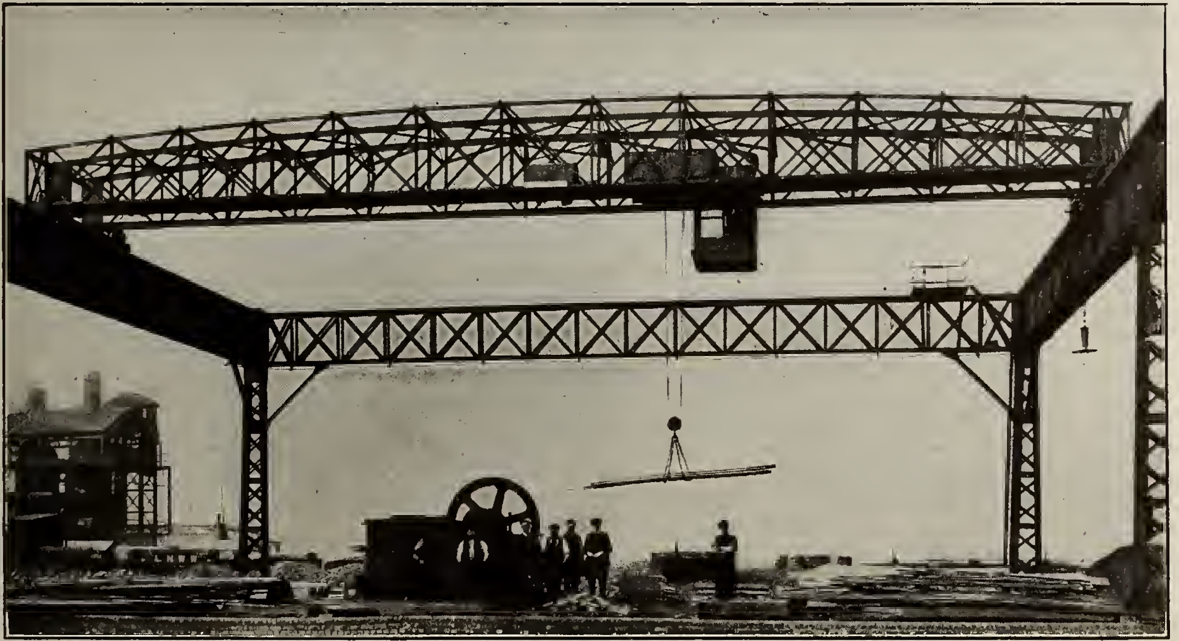

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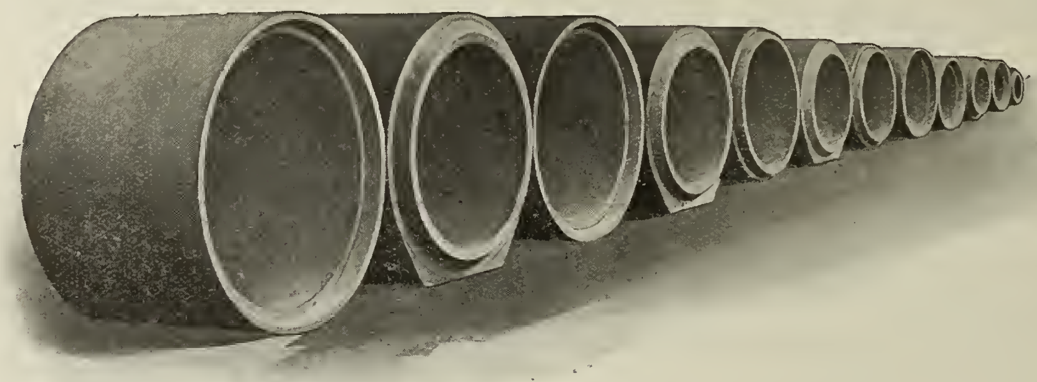
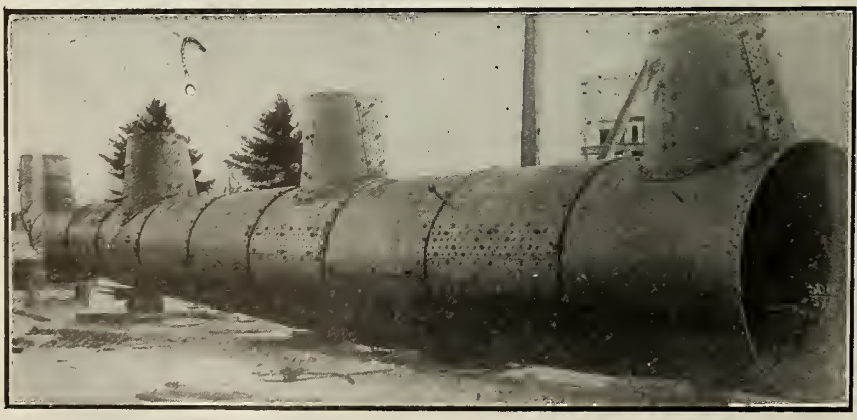
Architects and contractors throughout Canada now fully realize the wide possibilities of concrete for building purposes. We are running the most modern plant in Ontario, and make a point of meeting orders calling for special ornamental trimmings for public buildings, churches and schools. Our concrete manufactures comprise a full line of pipes and building materials, steam-cured by the latest scientific process. We can quote you on all concrete products.

Heavy reinforced concrete railroad pipe and cement drain tile our specialty.



National Concrete Mfg. Company, Limited
LINDSAY, ONTARIO



Erected at Seven Falls, Quebec, Distributor Pipe and Branches, under 450 ft. Head.

Structural and Steel Plate Work

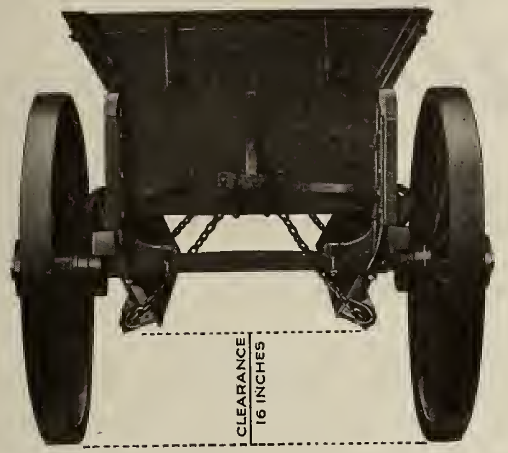
is our specialty. We fabricate and erect from your drawings, or will design your structure for you.

No Work Too Large for us to handle in the minimum of time. May we estimate on your requirements?

WALSH PLATE & STRUCTURAL WORKS, LIMITED

Drummondville, Que. Holyoke, Mass.

The Last Ten Dollars



in a dump wagon is the best part of its price. When we chose the Watson Wagon we selected the highest priced dump wagon of the lot. You get exactly what you pay for in this world, and although other wagons can be bought for less we wanted the best so that we could go back to our customers with a clear conscience.

John Deere Plow Co. of Welland, Ltd.
77-79 Jarvis St., Toronto, Ont.

**Brick Today
Stone Tomorrow**

Properly made sand lime brick of the best materials will eventually turn to stone under the influence of nature. Those desiring strong and permanent building material should

**SPECIFY
"Harbour"
Sand-Lime Brick**

Harbour Brick Co., Limited
50 Front Street E.
Toronto

LOW MAINTENANCE COST LOCOMOTIVES

THE life of a locomotive depends upon the care taken in manufacturing. Care in manufacturing increases profits by decreasing cost of maintenance and repairs.

From their long experience in locomotive building, our engineers have learned what is necessary to increase the life and usefulness of this class of equipment. They are qualified to co-operate with you in selecting the locomotive best suited for your work. Let them help you.

MONTREAL LOCOMOTIVE WORKS, LTD.
DOMINION EXPRESS BUILDING, MONTREAL, CANADA

Aikenhead's

Canada's Leading Tool House

Headquarters for Contractors Supplies of All Kinds

Our line is the best from the standpoint of workmanship, durability and price. A few of our specialties: **Tackle Blocks, Speidel Chain Hoists, Buda Jacks, K & J Scrapers, K & J Wheelbarrows, Joist Hangers, Bell Traps, Sand Shovels, Cement Tools, Jenkins' Valves, Pipe Fittings.**

Aikenhead Hardware Limited

17 Temperance St., Toronto, Can.

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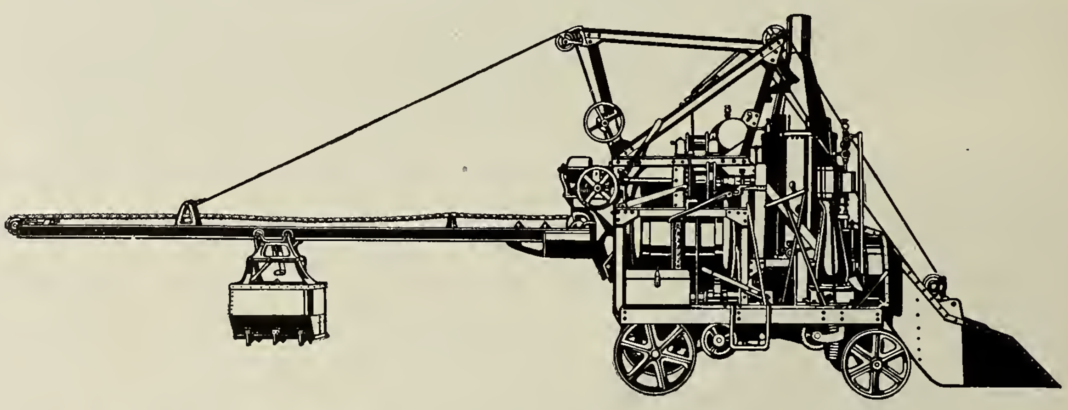

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"THE MIXER WITH THE BULGE"

¶ Machine is self-propelled, can travel one mile an hour on its own power and can climb a 10 per cent grade.

¶ Traction and drum drive are separate, so that when machine is travelling the drum does not revolve.

¶ Bucket travels on boom at the rate of 150 feet a minute, with a sure, simple, positive movement.

¶ The machine is for one man operation and the levers are all arranged so as to be workable in a natural sequence.

Send for catalog 59-H and get complete information

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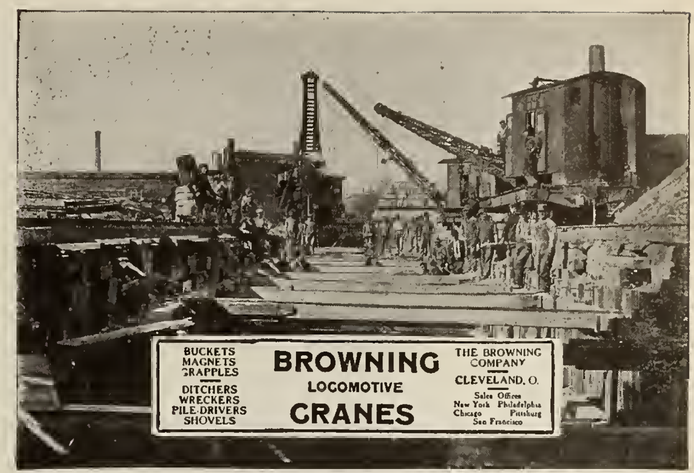
We have in stock
TROY DUMP WAGONS

Wm. McNally & Co., Limited
Builders' Supplies 50 McGill Street, MONTREAL



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LOCOMOTIVE
CRANES

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Raising the Wreck of U.S. Battleship Maine

Bulletin 102 Edition 2
Just off the Press

The perfect behavior of

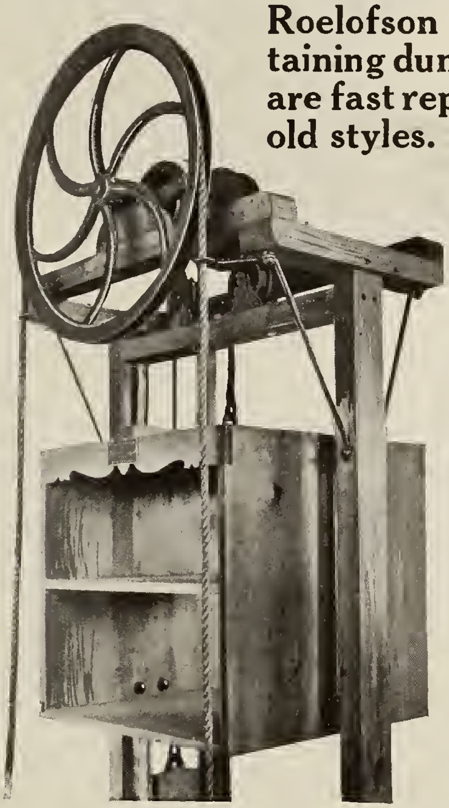
Lackawanna Steel
Sheet Piling

in the Maine work through the driving, filling of cofferdam pockets, unwatering and pulling of piling offer strong evidence of the success which is achievable in cofferdam and foundation work by proper use of this sheet piling. A copy of this bulletin will be sent to engineers and contractors on application.

H. A. Drury Co. Limited
Montreal and Toronto

DUMB WAITERS

Roelofson self retaining dumb waiters are fast replacing the old styles.



They are so constructed that they will hold the car stationary at any point desired without the use of brake or rope clamp.

We will furnish drawings and estimates of cost for special machines to be used as wall hoists, freight or invalid elevators.

Roelofson
Elevator
Works
Galt, Ont.

Keiths LIMITED

Do YOU intend installing, or have YOU thought of REFRIGERATION as applied to YOUR needs or processes?

Refrigeration--Ice Making
Cold Storage

TORONTO & MONTREAL

If so write us at address as below for information on this subject. We are anxious to talk this matter over with you and to give you the benefit of 35 years' experience of refrigeration.
Our address is
Head Office: 297 Campbell Ave., Toronto
Quebec Office: 707 New Birks Bldg. Montreal

AGENTS
The
FRICK
Company,
WAYNESBORO

Buffalo Single Cylinder Double Acting Power Pump

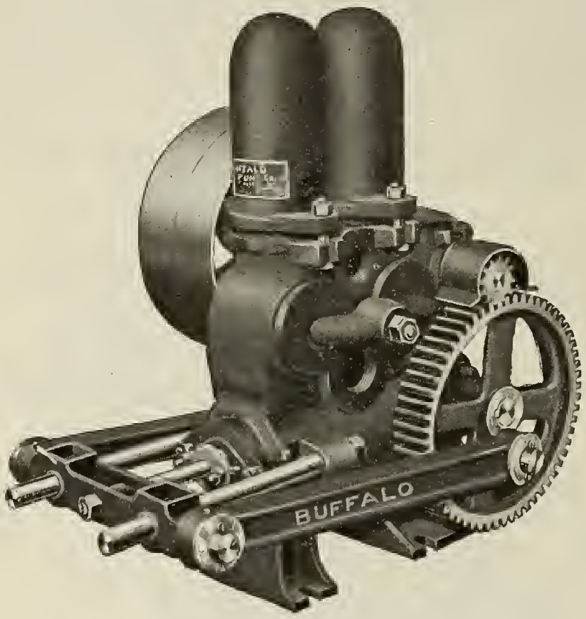


Fig. 401

The power pump illustrated is a distinct departure from the older competing designs now on the market. It will be noted that both the suction and discharge openings are above the cylinder. Because the suction valves are above the water piston the water contained cannot leak out when the pump is stopped. In other words the pump **always stays primed** and will immediately pick up its suction after a long period of rest because the cup leathers will not have dried out. This design is by far the best for handling water through long suction pipes and for the greatest convenience of operation. Two large air chambers are provided directly above the discharge valves where they are doubly effective and as they are easily detached the discharge valves are easily accessible. The suction valves are reached through two cover plates both of which may be taken off by removing one nut.

Metal to metal ground joint between head carrying crankshaft bearing and the main cylinder casting, giving absolutely accurate alignment.

Pump cylinders are brasslined, valves, valve seats and gland are brass; piston rods are brass fitted.

All bearings are lined with high grade babbitt and provided with large grease pockets with hinged covers.

Suction and discharge openings are provided on both sides of the pump.

Built in sizes 10 to 100 gallons per minute.

Send for Circular No. 255-C12.

Buffalo Steam Pump Co.
Buffalo, N. Y.

—Sole Canadian Agents—
Canadian Buffalo Forge Co., Limited
Berlin, Ontario
St. John, Montreal, Toronto, Winnipeg, Vancouver

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FOR

Engineers and Contractors

The following books are offered at special prices subject to previous sale:

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Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price $1.00.

Applied Perspective, by William P. P. Longfellow. Published in 1901 by Houghton, Mifflin & Company. 98 pages. Illustrated. Price $1.00.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price $1.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price $2.00

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited, London. 618 pages, well illustrated. Price $2.00.

Foundations of Bridges and Buildings, by Jacoby and Davis. Published in 1914 by McGraw-Hill Book Company. 602 pages. Illustrated. Price $5.00.

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Hugh C. MacLean, Limited
220 King Street West - Toronto, Canada

Lay 200 More Bricks Every Day

Hundreds of contractors to-day are laying 200 bricks more every day than they used to because they use

Renfrew Lime

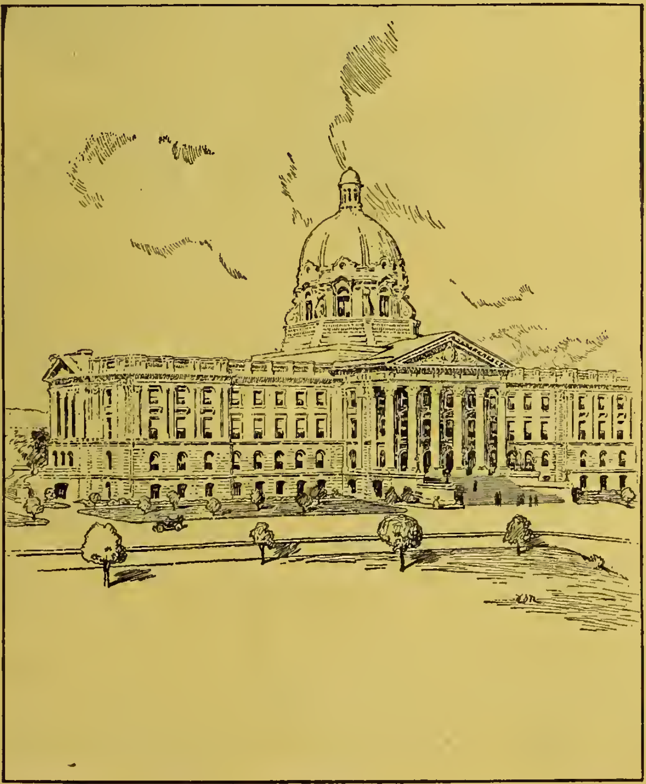
in their mortar. It makes the mortar much easier to handle and it goes farther.

You can save 75 cents a day on every bricklayer by using our lime in your mortar.

Try "Renfrew" on your next job.

White Lime
Gray Lime
Drain Tile
Brick, Stone

Jamieson
Lime Co.
Renfrew, Ont.



Across Canada with the

Imperial Wire & Cable Company, Limited

Sixth of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire and Cable Co's. Limited, wires.

This picture shows the

Parliament Buildings, Edmonton

This building was wired with

"Adanac" Rubber Insulated Wire

Architect: A. M. Jeffers, Edmonton.
Engineer: James McAlear, Chicago.
Electrical Contractors: Cunningham Electric Co., Calgary.

Address enquiries to our nearest office

Northern Electric Company
LIMITED

Montreal	Winnipeg	Edmonton
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Successor to IMPERIAL WIRE & CABLE CO., Limited

Correspondence previously addressed to Imperial Wire & Cable Co., Limited, at 611 C.P.R. Building, Toronto, and 902 Electric Railway Chambers, Winnipeg, should now be sent to Northern Electric Company, Limited, Simcoe St., Toronto, and 599 Henry Ave., Winnipeg.

WIRE ROPE

WIRE ROPE

MANUFACTURED BY
THE DOMINION WIRE ROPE CO., LTD., MONTREAL

"Industrial Works"
Locomotive-Coaling and Wrecking
CRANES
In capacities from
5 to 150 tons
For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.

BUCKETS
For Every Purpose

We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc., in all sizes.

We will gladly furnish full details upon request

We supply CONTRACTORS' EQUIPMENT of all descriptions

F. H. HOPKINS & CO., HEAD OFFICE MONTREAL
Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

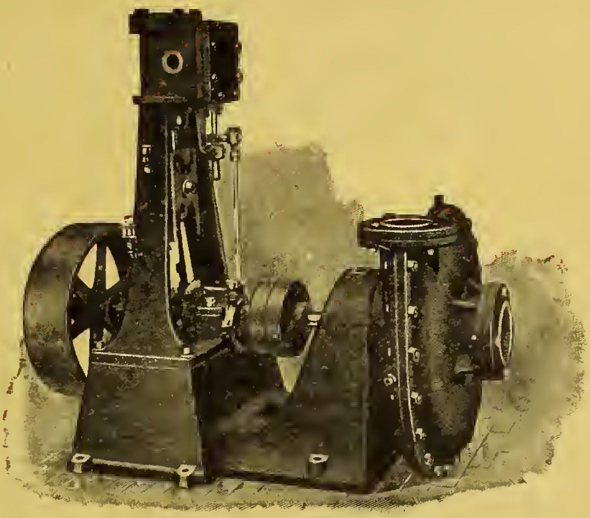
Vol. 28 Toronto, July 29, 1914 No. 30

Contract Record and Engineering Review

ESTABLISHED 1886

Smart-Turner Pumps

are in the first rank.



Steam Engine Driven Centrifugal Pump

They are favorably known from Vancouver to Halifax.

There is no larger factory in Canada devoting their entire energies to the manufacture of pumping machinery.

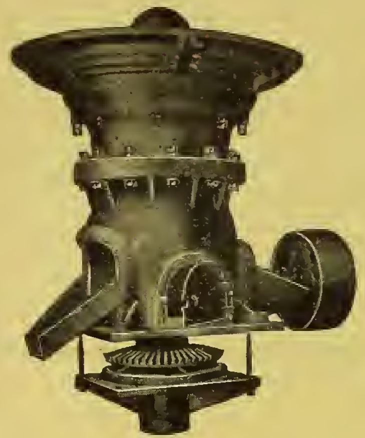
Estimates furnished on all classes of electrically driven, steam driven and centrifugal pumps.

Centrifugal Bilge and Sump Pump.

The Smart-Turner Machine Co., Ltd.

Hamilton, Canada

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 8



Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

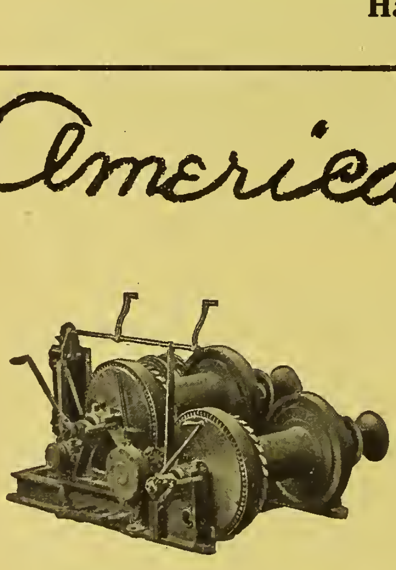
We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson

"American" Electric Hoists



do electrically the same high-grade work "American" Engines do by steam. They have the regular "American" Frictions; powerful, easy to operate, cool running—can be adjusted to offset wear.

There is an "American" Electric Hoist to meet every hoisting requirement—heavy or light, fast or slow. They are made with from one to three drums. Load is under absolute control at all times and can be locked at any point.

Motors are heavy type, variable speed and are capable of taking large overloads for short periods. The "American" Roller Ratchet prevents the load from dropping should the current suddenly fail.

American Hoist & Derrick Co
St. Paul Minn.

Sold by
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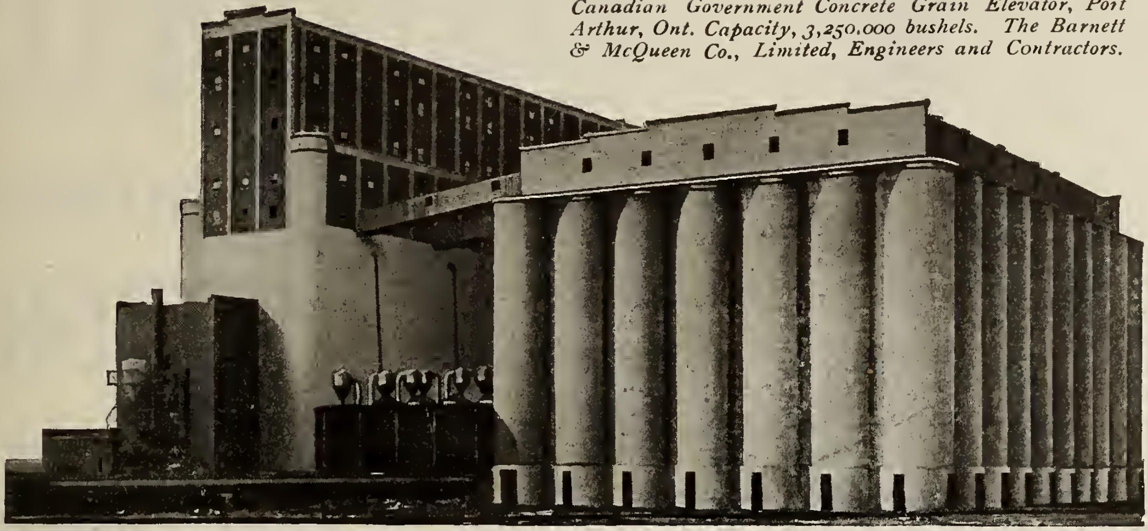
Vancouver Machinery Depot, Ltd.,
Vancouver, B. C.

Stuart Machinery Co., Winnipeg, Man.
Gorman, Clancey & Grindley,
Edmonton and Calgary, Alta.



Canadian Government Concrete Grain Elevator, Port Arthur, Ont. Capacity, 3,250,000 bushels. The Barnett & McQueen Co., Limited, Engineers and Contractors.

Government Adopts Concrete

The best evidence of the practicability and economy of concrete for the building of large structures is contained in this illustration of the Canadian Government Concrete Grain Elevator at Port Arthur, Ontario.

The practicability and economy of concrete lie in its adaptability to any structural design, its great strength and its durability. It is unburnable, practically indestructible and

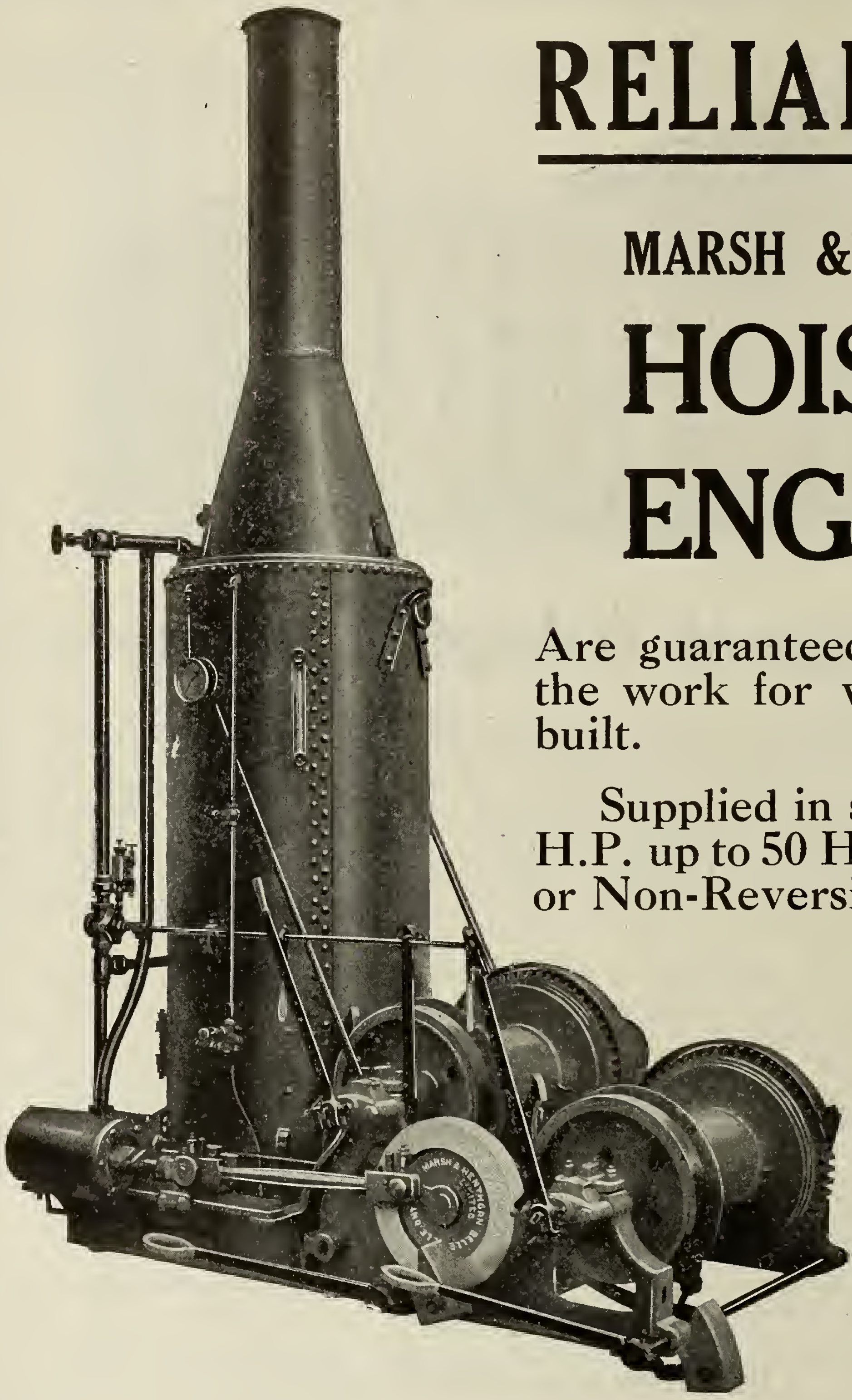
Minimizes Maintenance Cost

Concrete, on account of its adaptability affords unlimited possibilities in the design of all classes of structures. The fact that the greater part of the materials and labor that go into a concrete structure may be obtained locally makes its use economical and convenient from the viewpoints of both engineer and contractor.

Complete information about concrete structures will be sent to anyone interested, without charge. State nature of building on your postal card of request.

Information Department

Canada Cement Company
Limited
881 Herald Building, Montreal



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MARSH & HENTHORN
HOISTING ENGINES

Are guaranteed to stand up to the work for which they are built.

Supplied in seven sizes—10 H.P. up to 50 H.P.—Reversing or Non-Reversing.

Steam Hoists
Electric Hoists
Belt Drive Hoists
Horse Power Hoists
Hand Power Hoists

Mussens Limited

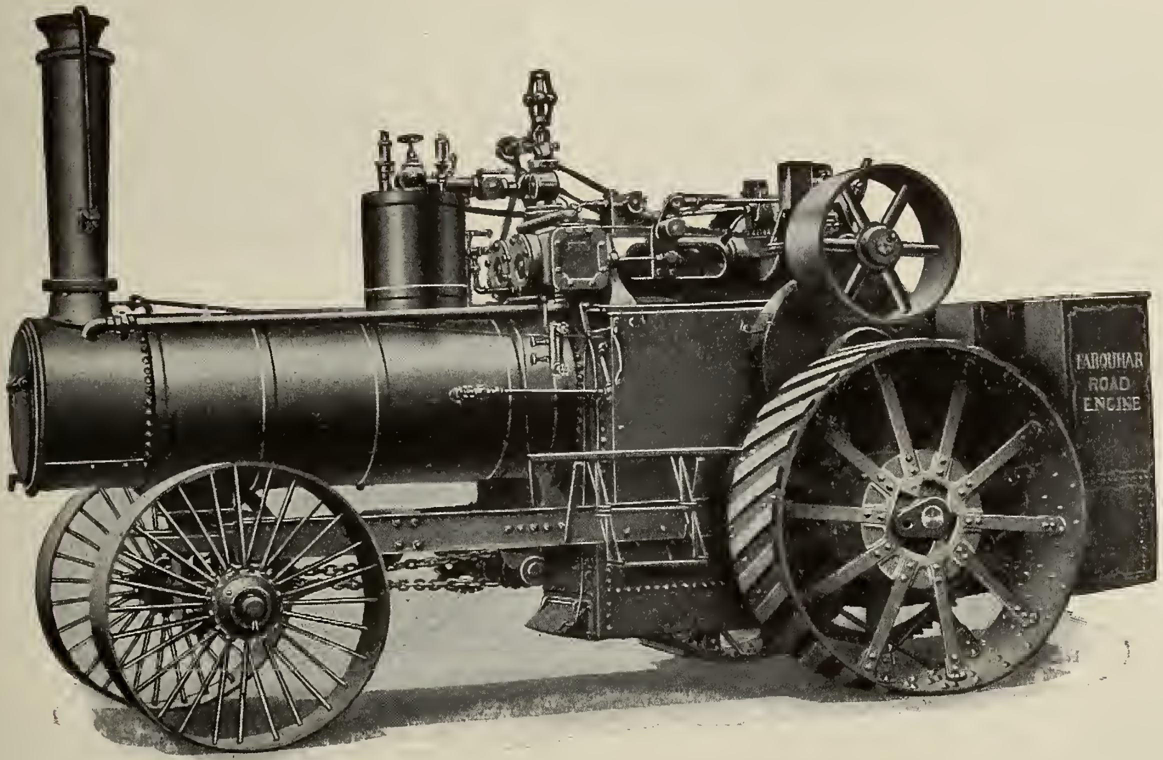
MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

DEPENDABLE POWER

Farquhar

Double Cylinder

Road Engines



The machine for general hauling and road building problems. Let us give you estimates on Engine versus Team Hauling.

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Mussens Limited

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(Continued on page 12)

A Real Joy Ride

What a pleasure it would be to ride along smooth, dustless, sanitary roads; amid the constantly changing scenery and through the bracing atmosphere—if all roads were paved with

BESSEMER
Wire-Cut-Lug Paving Block

A road paved with our block affords a strong, durable surface, a clean, dustless roadway and, above all, a true economy.

Withstanding varied climatic conditions and possessing qualities insuring a sanitary and noiseless roadbed, BESSEMER WIRE-CUT-LUG BLOCK typifies ideal road improvement.

Free booklet and detailed information will be sent promptly upon request.

Bessemer Limestone Company
Manufacturers of Bessemer Repressed and Dunn Wire-Cut-Lug Paving Block.
Youngstown, :-: Ohio.

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TRADE MARK.

A WORD FOR EFFICIENCY

"Sirocco" Multi-Blade Fan wheel built with capacities from 75 C.F.M. to 1,000,000 C.F.M. in single and double inlet types.

The word **"Sirocco"** applied to apparatus for Purifying—Cooling—Humidifying — Heating — Ventilating — Drying and Mechanical Draft stands for **a guarantee** of **highest efficiency.**

The **"Sirocco"** is the original fan of the many blade plan. **"Sirocco"** Fans save time over other types, because their design is such as to make use of **every bit** of energy with the least possible waste.

In specifying "Sirocco" Fans you're SURE they'll do exactly as claimed

A "Sirocco" Multi-Blade Fan will handle more air consuming less power than the ordinary steel plate fan twice the diameter.

Upon request we will gladly send to you a complete set of our Bulletins and Catalogues

Sales Engineers:

CLARK T. MORSE
301 McGill Bldg.,
Montreal

E. C. POWERS
43 Victoria St.,
Toronto

CANADIAN Sirocco COMPANY
LIMITED
WINDSOR, ONTARIO.

Sales Engineers:

W. P. EDDY
301 Tribune Bldg.,
Winnipeg

S. S. CLARKE
605 - 2nd St.,
Calgary

Head Office and Works

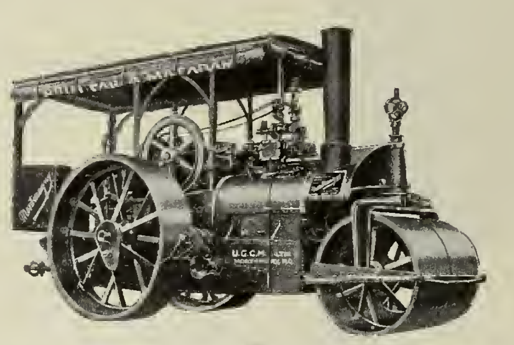
"Montmagny" Modern Road Builders

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



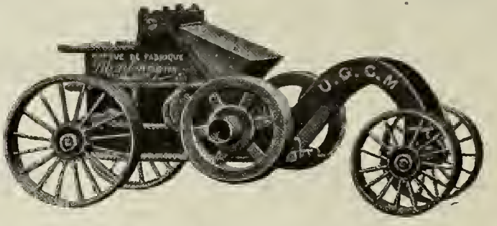
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"



"Montmagny" Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

"Montmagny" Portable Steel Bin.

Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

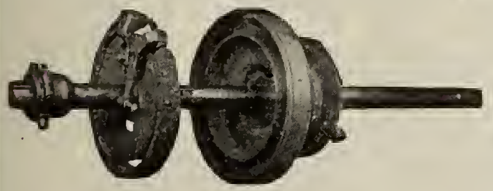
Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

Showing Features Which Insure

"Most Mixing, Least Fixin'"

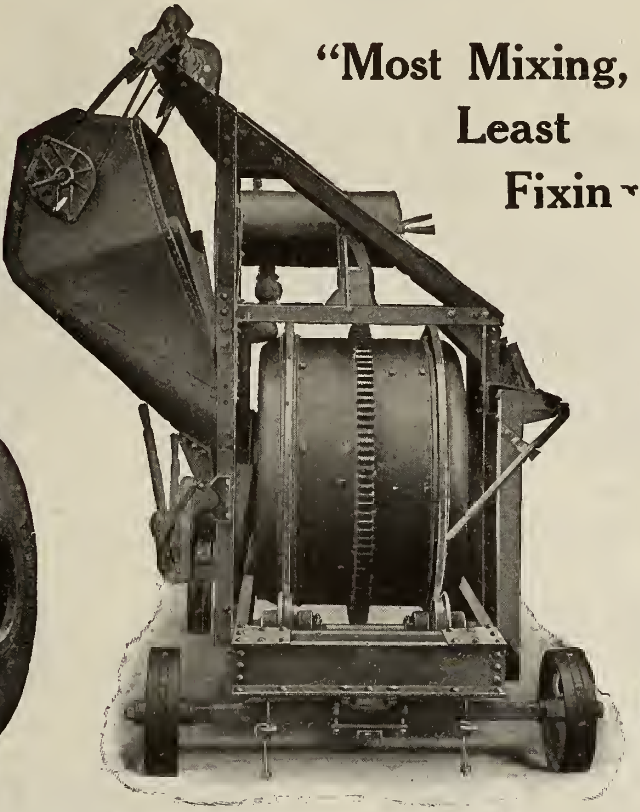
All-Steel Rail Tracks.
The M-C is the only mixer fitted with real railroad tracks around the drum. These rail tracks are of standard rolled steel sections. They run true and wear four or five times as long as cast-iron rings.

Cast Semi-Steel Drum
Made entirely of a high-grade semi-steel of great strength and toughness which offers maximum resistance to the severe scouring action of the sand and stone. A drum like this, more than half an inch thick, wears three or four times as long as a steel plate drum ⅛-inch thick.



M-C Friction Clutch
The M-C is the only mixer using the steel-band-lined-with-wood-blocks type of friction clutch which is the only type of clutch which will stand the severity of side loader service.

Discharge Half of Drum
Extra large and heavy steel buckets. Reverse the discharge spout and any batch is completely discharged in from 15 to 18 seconds. No square corners or dead spaces where concrete will set.



M-C Rail-Track Mixers

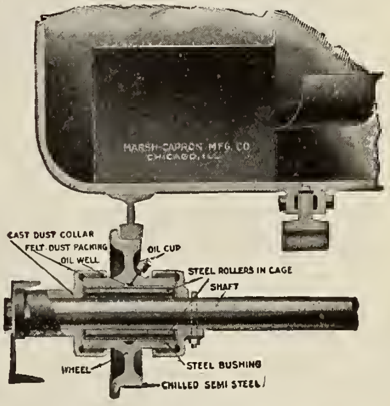
are built in the strongest manner possible for every kind of concrete construction work.

The standard line is built in many designs, in many sizes.

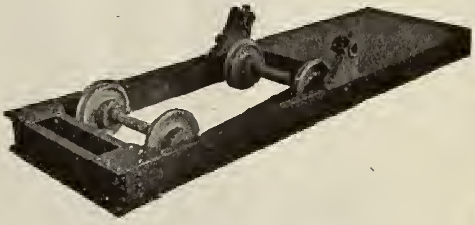
The paving mixers are the marvel of all who have seen them; being simpler, yet having every advantage of other pavers —— *and many advantages not found on other paving machines.*

A beautifully illustrated catalog has just been prepared telling all about the entire line. A copy is yours for the asking.

Segmental Drum Gear.
The M-C is the only mixer in which the main drum gear is built in segments bolted in place, to facilitate making repairs. If you have ever had trouble with a solid gear ring you will appreciate the advantages of this feature.



Detail of Roller-Bearing Wheels.
on which the M-C Rail Tracks roll. These wheels are of extra large diameter, are made of chilled semi-steel and are of the same type as used on cars in extremely severe mining service. They have heavy flange on one side, insuring straight, true turning of the drum regardless of its load.



Heavy Steel Channel Frame.
held square by steel plates. No twisting or binding of this frame is possible, so the true alignment of the machinery is always maintained.

Charging Half of Drum
Highly developed, practical, proven arrangement of heavy steel mixing blades insures thorough mixing.

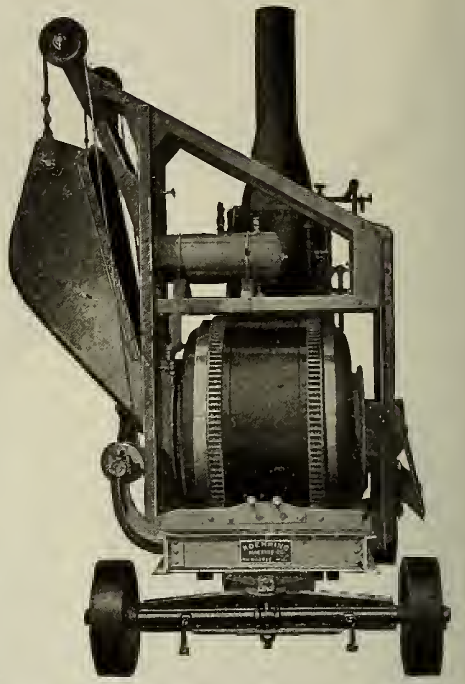
CANADIAN FAIRBANKS-MORSE CO., Ltd.

Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

Manufactured by
Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

NOTE THE PERPENDICULAR POSITION OF THE
Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.



KOEHRING MIXER
First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that **does more work.**

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do **more work** size for size, or, to do as much work with a smaller mixer.

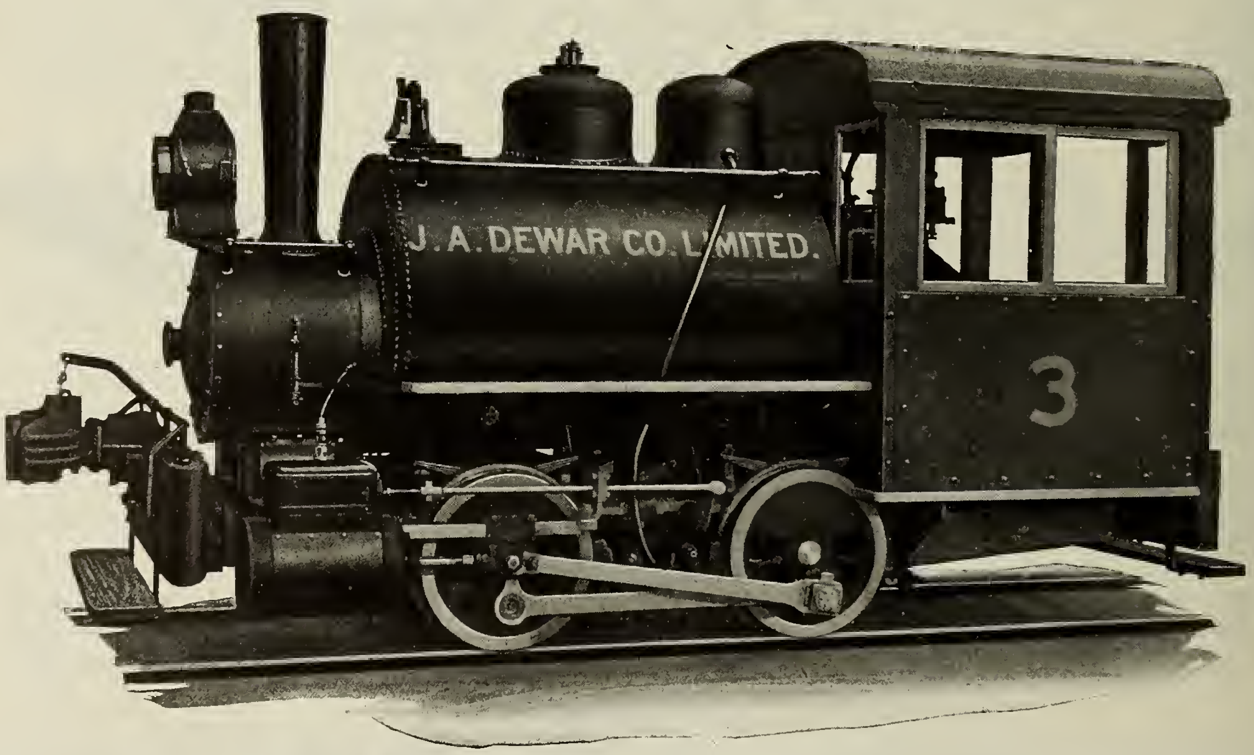
These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.

KOEHRING MACHINE CO. **Milwaukee, Wisconsin**

Canada Sales Agent: **CANADIAN-ALLIS CHALMERS CO., LIMITED**

Toronto Winnipeg Calgary Vancouver Montreal Ottawa

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

Concrete Mixers

—

Mortar Mixers

—

Concrete Block Machines

—

Cement Brick Machines

London Standard Drum Batch Mixer
This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Cement Tile Machines

—

Rock Crushers

—

Pumping Outfits

—

Hoists and Derricks

SINCE the advent of concrete construction we have kept apace with the steady demand for better concrete machinery. The famous London mixers represent the highest degree of perfection in concrete mixing equipment. They mix thoroughly, quickly and economical and the machines are built of good material to stand rough usage.

We are the largest manufacturers of high grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.

CORRESPONDENCE SOLICITED

Standard Hoisting Engine

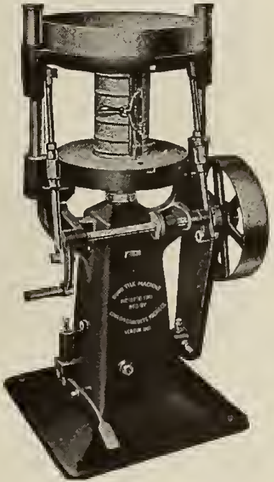
The London Concrete Machinery Co., Limited

Head Office and Factory:
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES:
Winnipeg—565 Portage Ave.—W. H. Rosevear, Manager.
Calgary—622 9th Ave. West—P. D McLaren, Manager.
Toronto—112 York Street—G. B. Oland, Manager.
Halifax—68 Upper Water Street—R. R. Power, Manager.

AGENCIES
Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Port Arthur and Fort William, Ont.—Northern Agency & Equipment Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

the Largest Manufacturers of Concrete Machinery in Canada



Dunn Cement Drain Tile Machine

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Drop Forgings
  Canadian Billings & Spencer, Ltd.

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  Manitoba Bridge & Iron Works
  Schell Foundry & Machine Co.
  Sheldons Limited
  Western Wheeled Scraper Co.

Dump Carts and Wagons
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  McNally & Co., Wm.
  Troy Wagon Works

Drying Apparatus
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Electric Fans
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Electric Air Rock Drills
  Canadian Ingersoll-Rand Co.

Electric Impulse Clocks
  Gent & Company

Electric Steel Castings
  Electric Steel & Metals Co.

Elevators
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  Turnbull Elevator Co.

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  National Builders' Supply & Enamel Concrete Brick Co.

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  Canadian Sirocco Company
  Inglis Company, John
  Jenckes Machine Company
  Laurie & Lamb
  Leonard & Sons, E.
  McDougall Caledonian Iron Wks.
  Mussens Limited
  Rock & Power Machinery
  Waterous Engine Works Co.

Engineers (Civil and Mechanical)
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  Campbell, R.
  Cape Company, E. G. M.
  Chipman & Power.
  Dominion Engineering & Inspection Company
  Farmer, John T.
  Galt Engineering Co., John
  Hamilton, S. W.
  Lea & Ferguson
  Mitchell, C. H.
  McDougall, Geo. K.
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  Thorold Company, F. W.
  Tyrrell, H. G.

Excavators
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  Municipal Engineering & Contracting Company
  Parsons Company, G. W.

Exhaust Heads
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  Sheldons Limited

Expanded Metal
  Mannesmann Tube Co.
  Pedlar People Limited

Fans
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  Sheldons Limited
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Fuel Economizers
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Electrical Machinery and Supplies
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  Sturtevant Co. of Can., Ltd., B. F.

Field Instruments
  Gurley, W. & L. E.

Filters
  American Water Softener Co.

Filtration Plants
  verMehr Engineering Co., John.

Fire Brick
  Ontario Lime Co., Ltd.
  Smyth & Ryan

Fire Escapes
  Manitoba Bridge & Iron Works
  McGregor & McIntyre

Fireproof Doors and Windows
  Feather & Roadhouse
  Hope & Sons, Henry
  Mussens Limited
  Pedlar People Limited
  Steel & Radiation Limited

Fuse (Safety Blasting)
  Lecky & Collis

Fixtures (Gas)
  Consumers Gas Company

Floor and Wall Tile
  Frontenac Floor & Wall Tile Co.

Folding Doors
  Springer, O. T.

Forges
  Canadian Buffalo Forge Co.
  Sheldons Limited
  Canadian Sirocco Co.

Forgings
  Canadian Billings & Spencer, Ltd.

Gas Engines
  Armstrong Mfg. Co.
  British Mfrs. Assn. of Canada

Gasoline Engines
  Armstrong Mfg. Co.
  Mills Bros.

Glass
  Consolidated Glass Company
  Excelsior Plate Glass Co.
  Luxfer Prism Company
  Pilkington Bros.
  Toronto Plate Glass Imp't'g Co.

Hammer Drills
  Canadian Ingersoll-Rand Co.

Heating Contractors
  Nobis Engineering Co.

High Pressure Pipe Lines
  Boving Company of Canada
  Escher Wyss & Co.
  Mannesmann Tube Company
  Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
  American Hoist & Derrick Co.
  Beatty & Sons, M.
  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Allis-Chalmers, Ltd.
  Canadian Fairbanks-Morse Co.
  Canadian Ingersoll-Rand Co.
  Jenckes Machine Co.
  Hopkins & Co., F. H.
  Lecky & Collis
  Marsh & Henthorn
  Morris Hoist & Crane Co., Herbert.
  Mussens Limited
  Rock and Power Machinery
  Royce Limited
  Sturtevant Co. of Can., Ltd., B. F.

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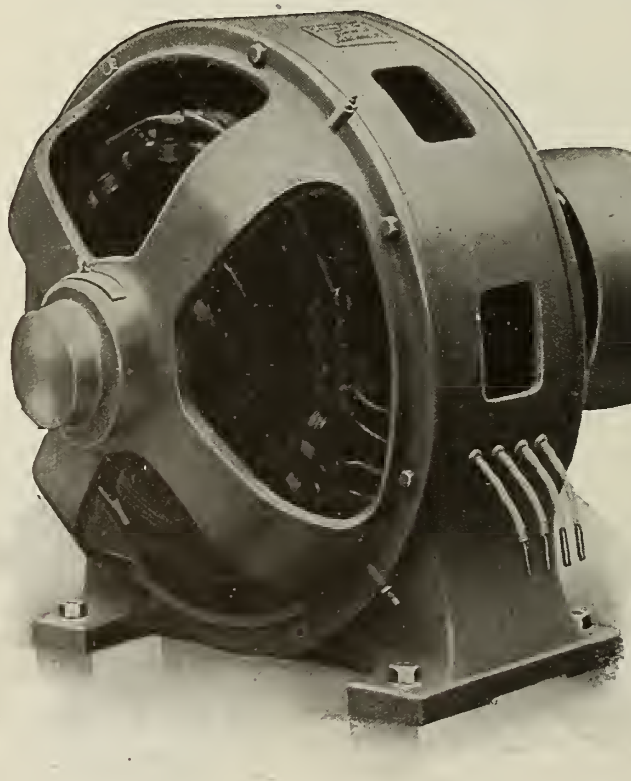


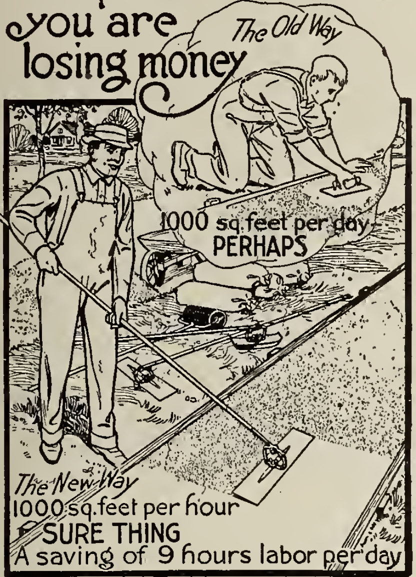
PEEBLES MOTORS

Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne Street
TORONTO

Farmers Advocate Bldg.
WINNIPEG

If you are not using
"ABRAM"
TOOLS
It is plain to be seen
you are
losing money



Abram Cement Tool Co.,
Windsor, Ontario

ROAD
MACHINERY

Western Road Machines have been in practical use for many years, and have given maximum satisfaction in the wide variety of soils.

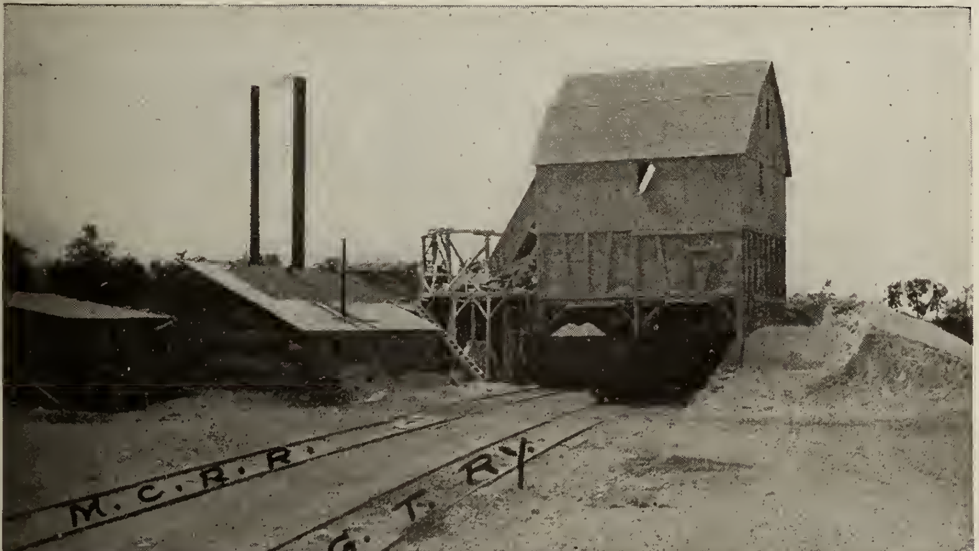
They are very strong and durable, simple in construction and easily operated.

Western Road Machines are adapted to the various phases of work in the construction and maintenance of roads and ditches. For permanent hard roads the Aurora Rock Crusher is a most important factor in reducing the stone to necessary size.

We manufacture the most extensive line of earth and stone handling machinery of any concern in the world. Write for catalogue.

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads



must be built of a
Tough
Stone
that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Heating Apparatus
  Canadian Buffalo Forge Co.
  Canadian Sirocco Co.
  Sheldons Limited

Hoists
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  Northern Crane Works

Hoisting Engines
  Canadian Allis-Chalmers, Ltd.
  Canadian Fairbanks-Morse Co.

Hydrants
  Canada Iron Corporation
  Gartshore-Thomson Pipe Co.
  Kerr Engine Company

Industrial Cars
  Central Locomotive & Car Works

Insulating Compounds
  Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
  Canada Office & School Fur. Co.
  Rhodes Curry & Company

Jib Cranes (all kinds)
  Brown Hoisting Machinery Co.
  Morris Crane & Hoist Co., Herbert

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  Jamieson Lime Company
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Lighting and Pumping Installations
  Lister & Co., Ltd., R. A.

Locks
  Can. Yale & Towne Ltd.

Locomotives
  Boving Company of Canada
  Central Locomotive & Car Works
  Canadian Allis-Chalmers, Ltd.
  Canadian Locomotive Company
  Montreal Locomotive Works
  F. H. Hopkins Company
  Mussens Limited

Metal (Anti-Corrosive)
  Stark Rolling Mill Co.

Metal Hose
  Lytle, Smith & Co.

Metal Lath
  Greening Wire Co., B.
  Metallic Roofing Co.
  Noble, C. W.
  Pedlar People Limited.
  Steel & Radiation Ltd.

Meters, Electrical
  Siemens Co. of Canada, Ltd.
  Ferranti Electrical Mfg. Co.
  Canadian Allis-Chalmers, Ltd.

Mechanical Draft Apparatus
  Sturtevant Co. of Can. Ltd. B. F.

Meters, Water
  Hopkins & Co., F. H.
  McDougall Caledonian Iron Wks
  Neptune Meter Co.
  Peacock Brothers
  Siemens Co. of Canada, Ltd.

Overhead Runways
  Brown Hoisting Machinery Co.
  Morris Crane & Hoist Co., Herbert.

Paints and Varnishes
  Dominion Paint Works
  Hopkins & Co., F. H.

Paving and Paving Materials
  Asphalt & Supply Co.
  Aztec Oil Asphalt Co.
  Bessemer Limestone Co.
  Baker Co., R. D.
  Barber Asphalt Paving Co.
  Dunn Wire-Cut-Lug Brick Co.
  Ontario Asphalt Block Co.
  Paterson Mfg. Co., B.

Pipe (Concrete, Iron and Wood)
  American Spiral Pipe Works
  Canadian Allis-Chalmers, Ltd.
  Canadian Pipe Co.
  Dominion Concrete Co.
  Gartshore-Thomson Pipe Co.
  Gerald Lomer, Ltd.
  Mannesmann Tube Company
  National Concrete Mfg. Co.
  National Iron Works
  National Pipe & Foundry Co.
  Pacific Coast Pipe Co.
  Piggott & Co., Thos.
  Steffens & Nolle
  United States Cast Iron Pipe Co.
  Vancouver Wood Pipe & Tank Company.
  Walsh Plate & Structural Works.

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Paints (Bridge and Structural Iron and Pipe Coating)
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  Canada Wire & Iron Goods Co.
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Pipe Machinery
  Sutcliffe, Speakman & Co.

Pile Driving Machinery
  American Hoist & Derrick Co.
  Browning Company
  Brown Hoisting Machinery Co.
  Canadian Ingersoll-Rand Co.
  Lecky & Collis

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  Pittsburgh Valve, Foundry & Construction Company

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  Mueller Mfg. Co., H.

Planing Mill Exhausters
  Canadian Buffalo Forge Co.
  Sheldons Limited
  Canadian Sirocco Co.

Plaster
  Alabastine Hardmortar Co.
  Albert Mfg. Company
  Britnell & Company
  Ontario Lime Co., Ltd.

Plate Glass
  Excelsior Plate Glass Co.
  Pilkington Bros.

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24 Milburn Lights

Purchased by the Canadian Government for use in the Hudson Bay District.

This is just another proof of the supremacy of Milburn Lights. Wherever reliability is required Milburn Lights are chosen.

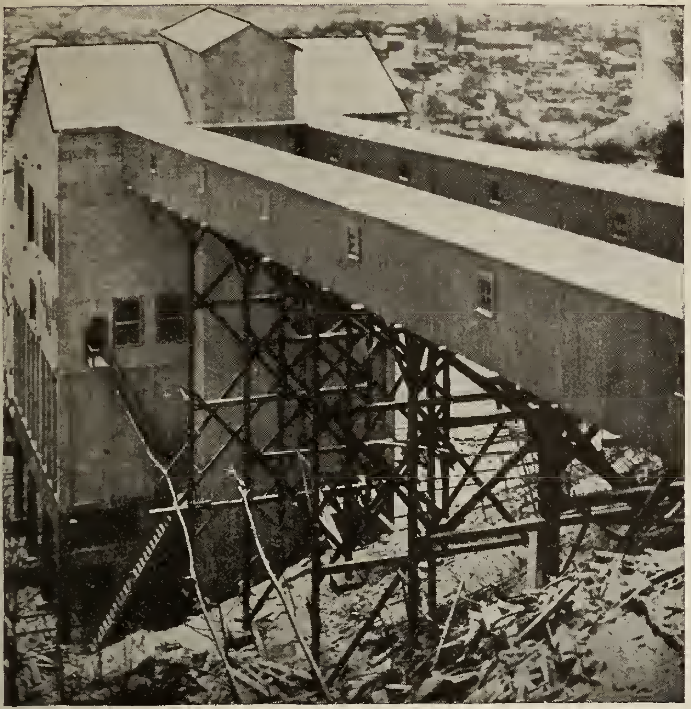
Made in different styles and sizes to suit various requirements. Easily detachable and most economical. Costs only a few cents per hour.

Send for Catalogue

The Canadian Fairbanks - Morse Co., Limited

Montreal Toronto Winnipeg Calgary
Quebec Ottawa Regina Edmonton
St. John Hamilton Saskatoon Vancouver
Ft. William Victoria

Canada's Departmental House for Mechanical Goods



Storage Bins, Capacity 2000 Tons

Crushed Stone

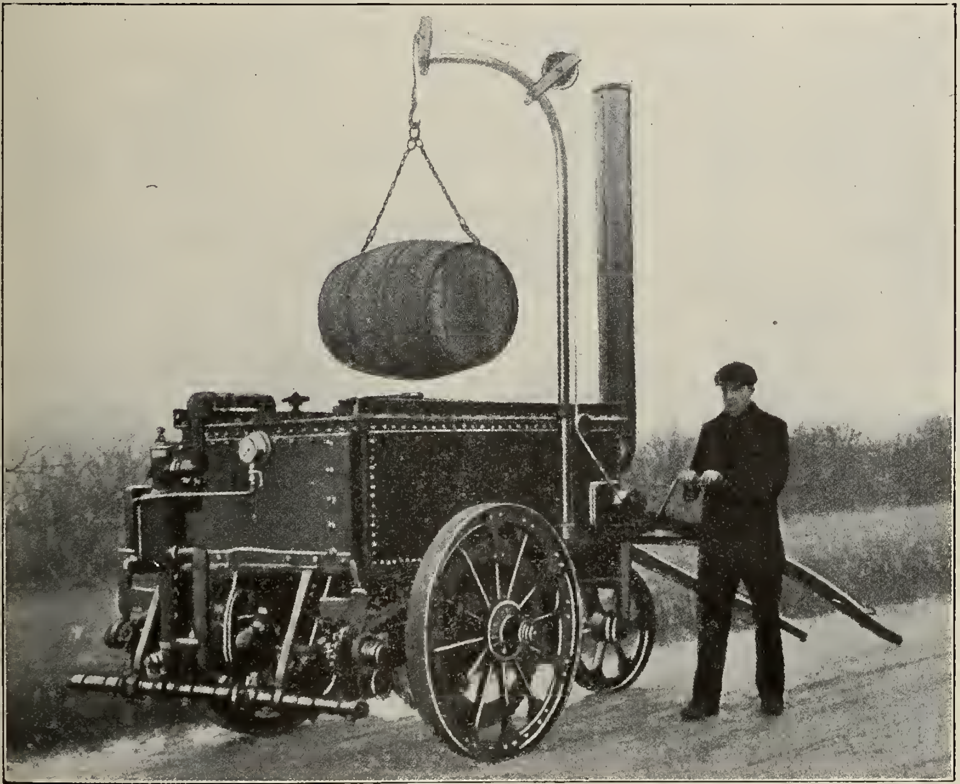
All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario



For Surface Treatment of Roads the

TAROADS

patent Machines are far in advance of any other Tar Spraying apparatus on the market for

Efficiency
and
Expedition

(penetration assured.) They are capable of DOUBLE the output of all others machines.

Write for illustrated folders.

ENQUIRIES SOLICITED

Cables:
TAROADS - LONDON

TAROADS SYNDICATE, LTD.

(Sir Herbert B. M. Praed, Bart.)

9 VICTORIA STREET
WESTMINSTER, LONDON, Eng.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

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Canadian Fairbanks-Morse Co.
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Canadian Sirocco Co.
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Hamilton Mfg. Co., Wm.
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Morris Machine Works.
Smart-Turner Machine Co.
Waterous Engine Works Co.
Mussens Limited
Ontario Wind Eng. & Pump Co.
Rock & Power Machinery

Portable Saws
Canadian Fairbanks-Morse Co.

Portable Track
Bechtels Limited

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Sutcliffe, Speakman & Co.

Plug Drillers
Canadian Ingersoll-Rand Co.

Power Engines
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Jenckes Machine Company
Canadian Allis-Chalmers, Ltd.
Waterous Engine Works

Quarry Machinery
Canadian Allis-Chalmers, Ltd.
Canadian Ingersoll-Rand Co.
Improved Equipment Co.
Jenckes Machine Company
Lecky & Collis
George Anderson & Co.
Goodwin, Barsby & Company
Rock & Power Machinery, Ltd.

Railway Supplies
Gartshore, John J.
Hopkins & Co., F. H.
Lecky & Collis
Mussens Limited

Reinforcements, Concrete & Steel
Brown Hoisting Machinery Co.
Burlington Steel Company
Canada Wire & Iron Goods Co.
Dominion Iron & Steel Co.
Greening Wire Co., B.
Pedlar People Limited.
Steel & Radiation Ltd.
Trussed Concrete Steel Co.
Turner, C. A. P.

Radial Brick Chimneys
H. R. Heinicke Inc.

Refrigeration Machinery
Equipment & Supplies, Limited
Keiths Limited

Road Asphalt
Asphalt & Supply Co.
Barber Asphalt Paving Co.

Road Machinery
Exeter Mfg. Co., Ltd.
General Car & Mach. Works
Jenckes Machine Company
Lecky & Collis
Morrison & Co., T. A.
Mussens Limited
Waterous Engine Works Co.
Western Wheeled Scraper Co.

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Goodwin, Barsby & Company
Greening Wire Co., B.
Jenckes Machine Company

Roof Glazing
Hope & Sons, Henry

Roofing Material
Asbestos Mfg. Company
Barber Asphalt Paving Co.
Bird & Son
Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Metallic Roofing Company
Noble, Clarence W.
Paterson Mfg. Co.
Pedlar People, Limited

Rubber Belting
Canadian Fairbanks-Morse Co.

Safes and Vaults
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Ontario Lime Co., Ltd.
Sand and Supplies Limited
York Sand and Gravel Co.

Sash Weights
Fittings, Limited

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Canada Wire & Iron Goods Co.
Goodwin, Barsby & Company
Greening Wire Mfg. Co., B.
Weller Mfg. Co.

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British Mfrs. Assn. of Canada

Sewer Pipe
Britnell & Company
Canada Iron Corporation
Canadian Sewer Pipe Co.
Dominion Sewer Pipe Co.
Gartshore Thomson Pipe Co.
Hamilton & Toronto Sewer Pipe Co.
National Iron Works
Nova Scotia Clay Works Ltd.
Ontario Lime Co., Ltd.
Ontario Sewer Pipe Co.
Smyth & Ryan
Standard Clay Products Ltd.

Sewer Trenching
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Canadian Allis-Chalmers, Ltd.
Montreal Locomotive Works
Mussens Limited
Rock & Power Machinery, Ltd.
Thew Automatic Shovel Co.

Skylights
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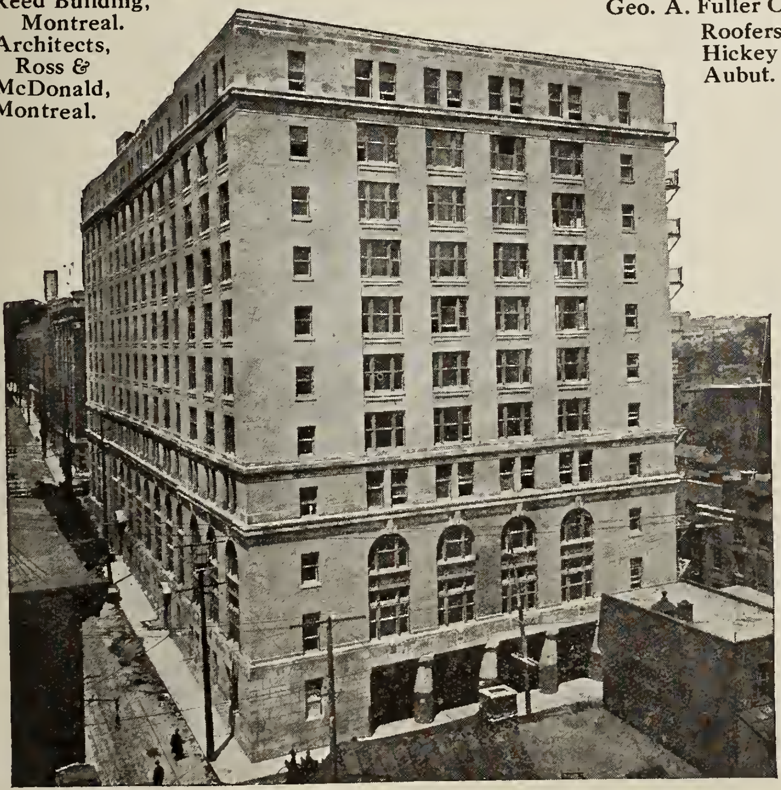

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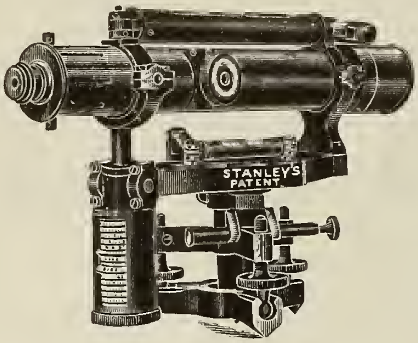

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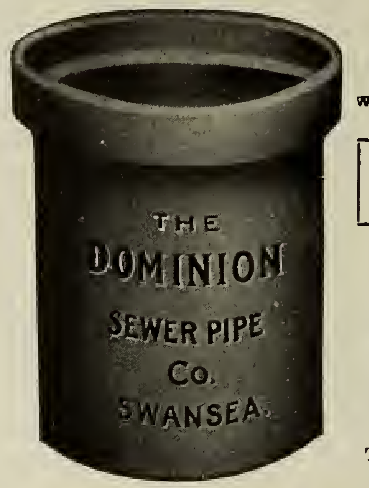

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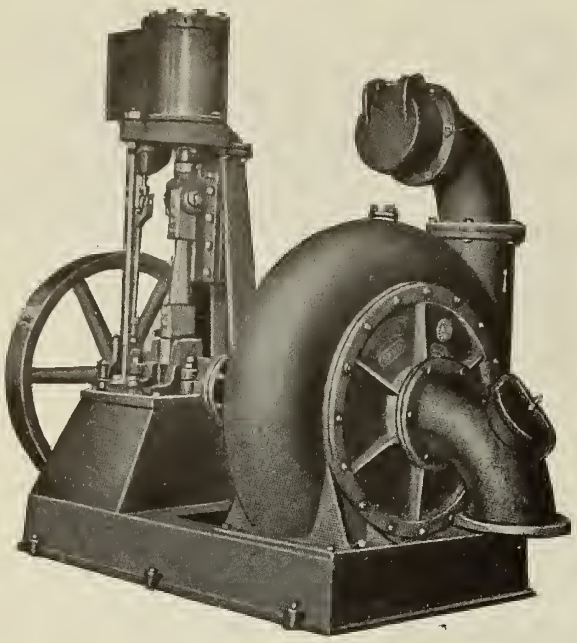

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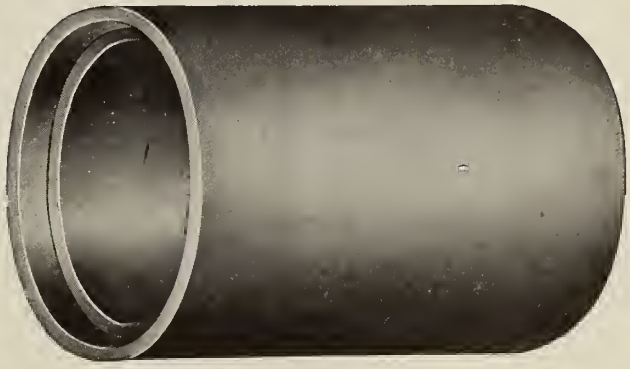

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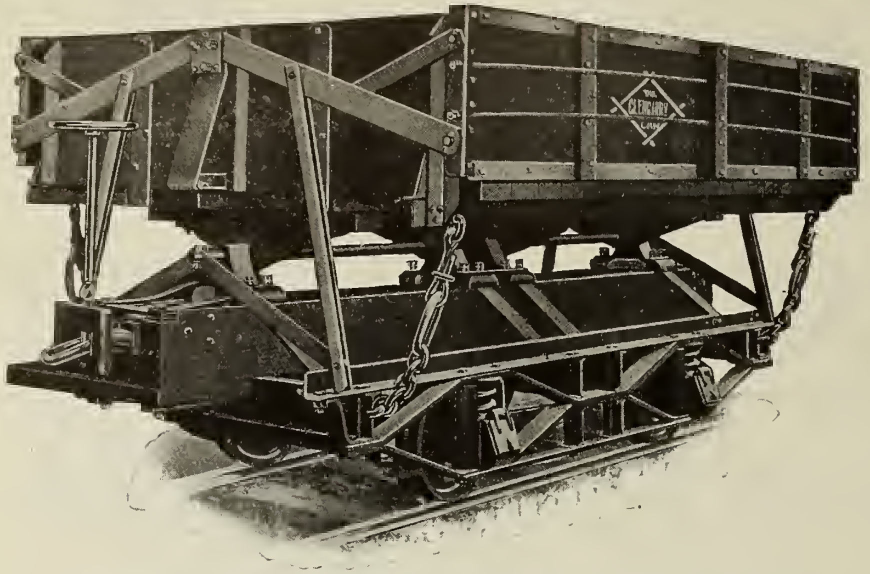

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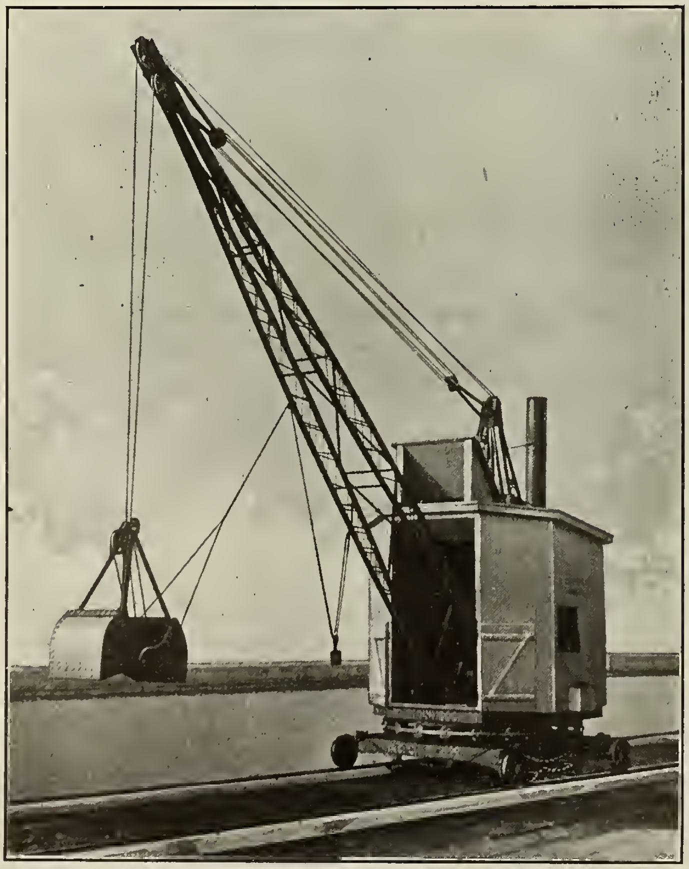

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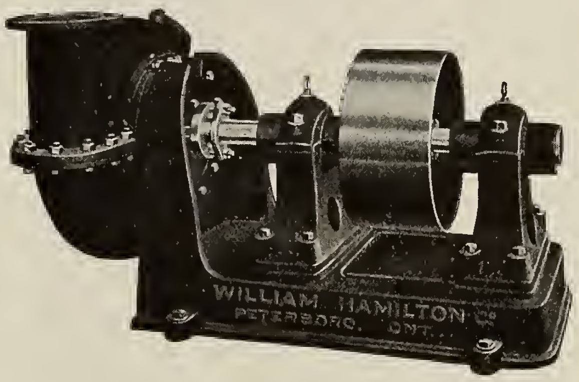

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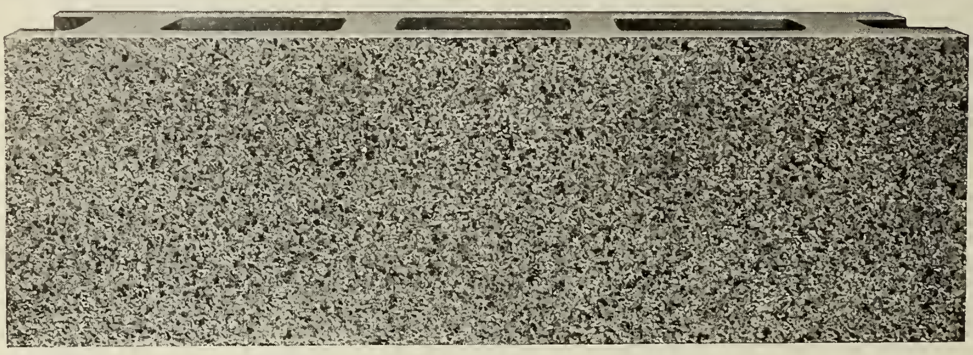

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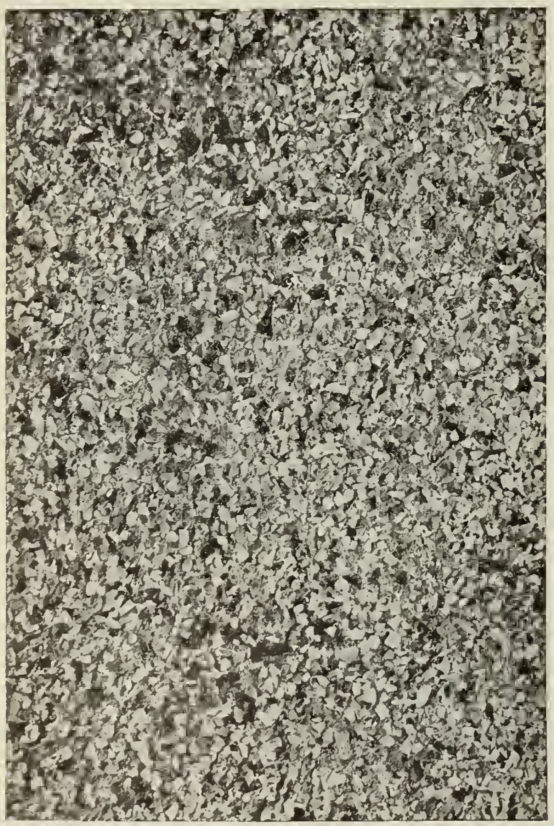
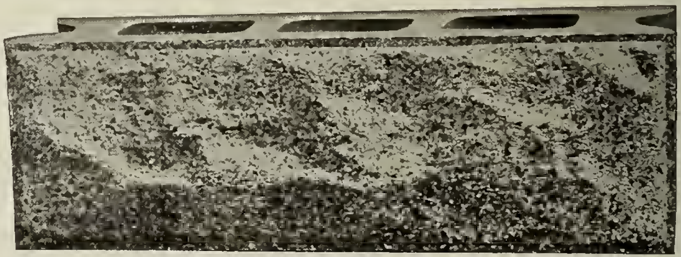


Enlarged View of Granite Smooth Facing

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold or moisture.



8 x 8 x 24 inch Granite Rock Face Block

Send us fifty cents and we will send, freight prepaid, to any point in Ontario, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

MR. BLOCK MAKER:—

What show will you have if your competitor secures the exclusive right for this system in your city?

MR. CONTRACTOR:—

Get into a business that is protected. Then you will make money.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Canadian Zagelmeyer Co.

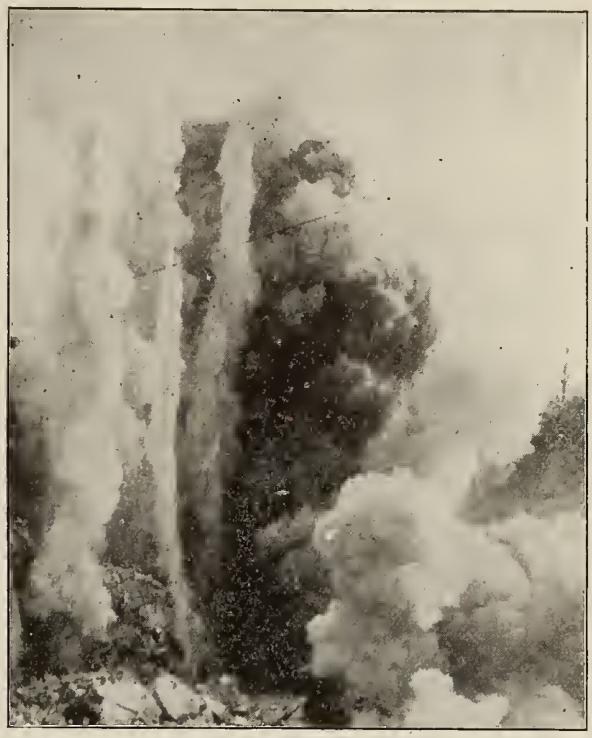
Limited

298 Howard Ave., Windsor, Ontario

Which is the Cheaper and Better Way?

6 small bench shots like this—each one stopping work of the steam shovels, dinky engine crews and cars—and laborers.

or



One big face blast—one stop for shovels, engine crews and cars as done by

Armstrong
BLAST HOLE DRILLS
BUILT FOR SERVICE SINCE 1867

Special Blast Hole Cable Drills

A FEW WORDS ON BLAST HOLE DRILLING

Economical blast hole drilling is a matter of getting the greatest footage of hole drilled in the shortest time with the least possible cost. The blow of the falling string of tools is the real factor in the case, and upon the conditions surrounding the action of the drilling tools depends the economy of the process. With a given weight of tools, the speed of drilling depends upon the length of the stroke, to be more exact, the actual height of drop of the tools, and the number of strokes per minute which can be freely made. These two conditions are vital to rapid and efficient blast hole drilling and are made nearly 100 per cent efficient in the "Special Armstrong Blast Hole Drill."

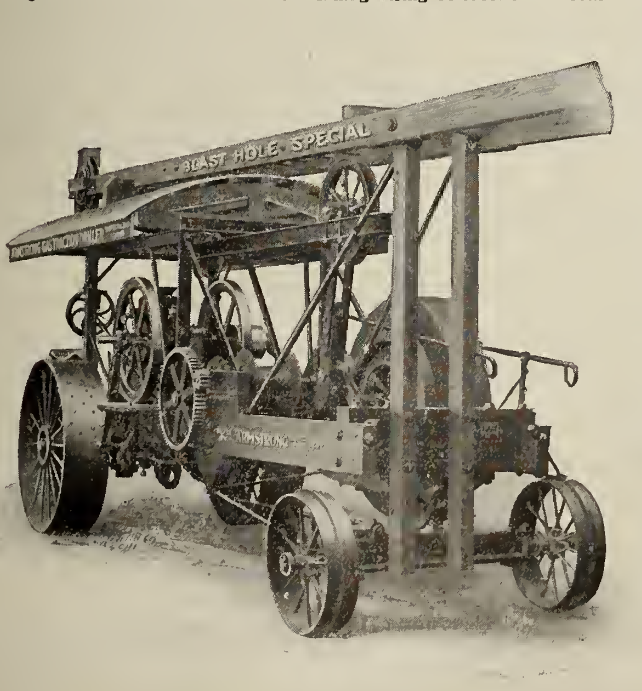
This is how we do it:

The "Special Armstrong Blast Hole Drill" embodies an important feature of design not found in any other type of cable drill made today, which makes possible the wonderful records which it is achieving in quarries throughout the country. The above mentioned improvement lies in the straight crank motion of the spudding beam and the proper location of the spudding sheave. It eliminates the "whipping" of the cable, it increases the lift of the tools on each stroke and makes possible a greater number of strokes per minute for a given crank throw and gives an absolutely free drop to the tools. In other words, it makes more efficient the two conditions which are required for rapid drilling, the greatest number of powerful blows; in other words, the maximum foot pounds of energy delivered at the bottom of the hole, within a time limit.

We can prove with authoritative records covering in detail periods of six months' duration that the increased efficiency of the Special Armstrong Blast Hole Drill is from 40 to 50 per cent over similar sized cable drills of other makes.

Fundamentally and finally, this machine is built for *BLAST HOLE* purposes only. It is not a well drill. We do not furnish it for any other purpose than drilling blast holes. Let us know your conditions and we *absolutely guarantee* an increased footage per day or over a long period at a lower cost.

Write for Bulletin S. giving data and records, and let us have an opportunity to prove our case.



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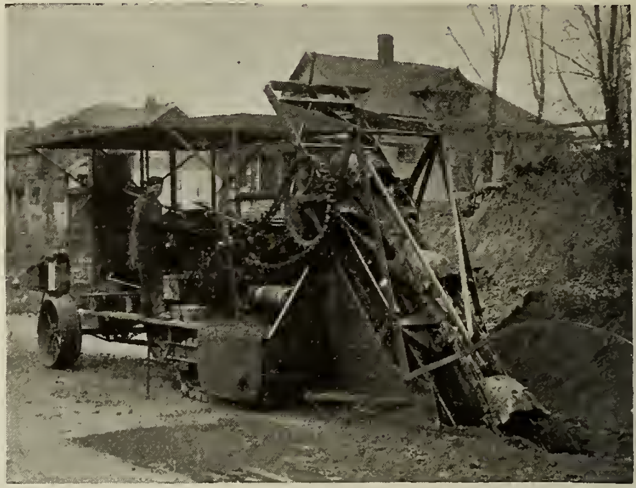
Austin Trench Excavator Service Records



Edmonton, Alta.

"This machine in good stiff digging, in hard clay, at a depth of 18 feet and 40 inches wide, has carried a digging speed of three lineal feet per minute."

Medicine Hat, Alta.

"The No. 0 steam trenching machine is doing very superior work. It has excavated in rather hard clay at the low cost of 2.4 cents per cubic yard."

What secrets lie behind this phenomenal ability of Austin Trenching Machines? None. Simply GREAT care in attention to details, the elimination of the old-fashioned "shift mechanism;" the use of the **straight-pull**; the buckets digging constantly the full width of the trench. All sizes of Austin Trench Excavators are equally efficient because the principle is exactly the same in all of them—the larger are merely made stronger and heavier than the smaller.

Write to our Canadian Representatives:
Lecky & Collis, Limited, 49 Beaver Hall Hill, Montreal; 43 Scott St., Toronto, and P. O. Box 611, Napanee, Ontario.
The Canadian Equipment & Supply Co., Calgary. E. G. Cullen, Vancouver, 418 Pacific Bldg.

F. C. Austin Drainage Excavator Company

Railway Exchange, Chicago, U. S. A.

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Best Metal Protection

is protected by the very latest and best development in the art of galvanizing. Professor Burgess, Metallurgist of the University of Wisconsin, reports that it took him 304 minutes to dissolve in dilute acid, a given amount of filings from the sherardizing coating. It only took 20 minutes to dissolve the same quantity of filings from hot galvanizing.

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Clarence W. Noble, *General Sales Agent*

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Hull Iron & Steel Foundries, Limited

HULL, - QUEBEC

Manufacturers of

"Adamantine," Chrome and Manganese Steel Castings

(Annealed and Unannealed)

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Machine - Moulded Gears up to 16 feet. Grey Iron, Semi-Steel, Brass Bronze and Aluminum Castings.

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Our Specialty

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Griffin Mill Roll Heads
Ball Mill Plates for Krupp Mills
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McCaslin Conveyer Wheels with "Coplan" Self-Lubricating Bushings
Lining Plates for Bonnot Tube Mills
Parts for Bonnot Pulverizers
Screw Conveyer Bearings
Eccentric Hubs, Crusher Heads and Concave Strips for Gates Crushers
T. M. Revolving Feeders (new style) for Gates Tube Mills

Patterns for all these lines kept on hand.

We solicit your patronage and prompt attention will be given to tenders on above work.

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For damp proofing brick work.
To prevent mortar stains on stone.
As a metal preservative to resist acid fumes.

Write for "1914 Edition of Red Book" giving specifications for different compounds for different purposes.

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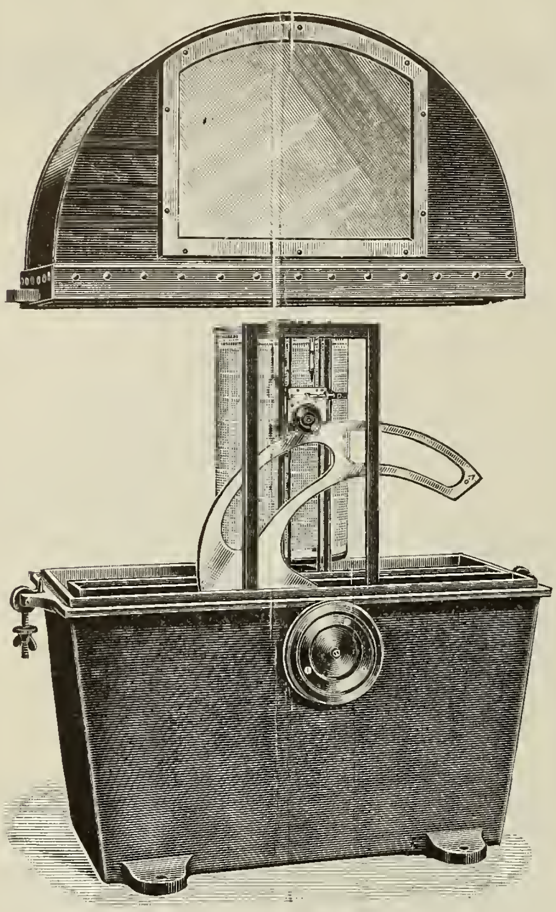
Office: 202 Mail Building, Toronto (TOCH BROS.) **Factory: Oakville, Ont.**

DISTRIBUTORS—Black Building Supply Co., Limited, Toronto Western Paint Co., Winnipeg
Dartnell, Limited, Montreal Canadian Equipment & Supply Co., Limited, Calgary and Edmonton
Write nearest distributor for full information



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are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of waterway, and are strong, compact and modern in design and construction.

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Send us your Specifications and Enquiries.

Prompt attention given.

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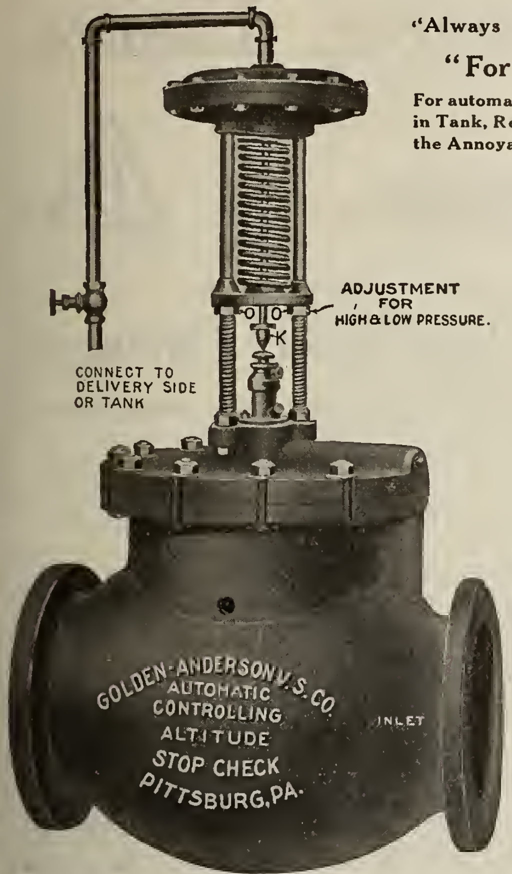
The Golden-Anderson Pat. Cushioned Controlling Altitude Valves



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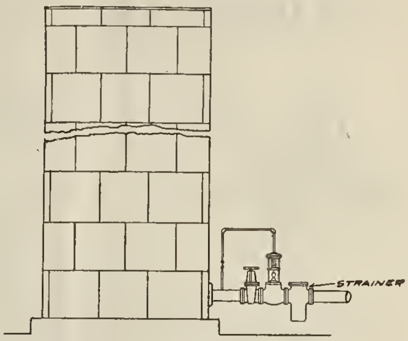
"For High and Low Pressure"

For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.

Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.



Automatic Cushioned Water Pressure Regulating Valves, up to 24"

Golden-Anderson Float Valves

(Angle or Straight Way), up to 24"

Golden-Anderson Valve Specialty Co., 1247 Fulton Bldg. Pittsburgh, Pa.

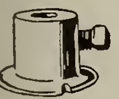


Fig. 1

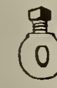


Fig. 2

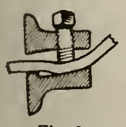


Fig. 3

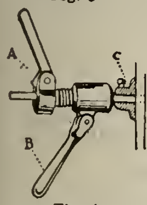


Fig. 4

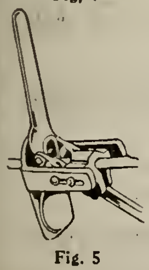
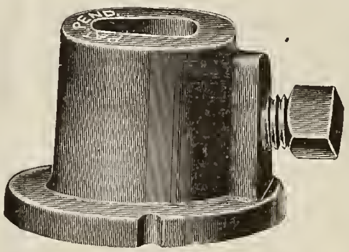


Fig. 5

Use UNIVERSAL CLAMPS

to convert any round rod into a bolt



Long bolts—removable bolts—bolts extending through timber and poured concrete—these are best for form work.

The Universal Form Clamp converts round rods of any size into threaded bolts with removable heads and adjustable nuts.

Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section. showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screw is tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

One Clamp for walls, columns and soffits This clamp is literally *universal* in application. With these low cost cast iron clamps and various lengths of steel rods, forms may be held rigidly in place during the entire process of building.

Write for circulars and prices. We'll send a sample clamp for 10c. to pay postage and packing.

Universal Form Clamp Co.

Sole Representatives for Ontario and Eastern Canada:

Railway Contractors Supply Company

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Universal Form Clamp Co., 504 Standard Bank Bldg., Toronto

I enclose 10c. Please send me a sample Universal Clamp.

Name..............................

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Canadian Billings & Spencer, Limited

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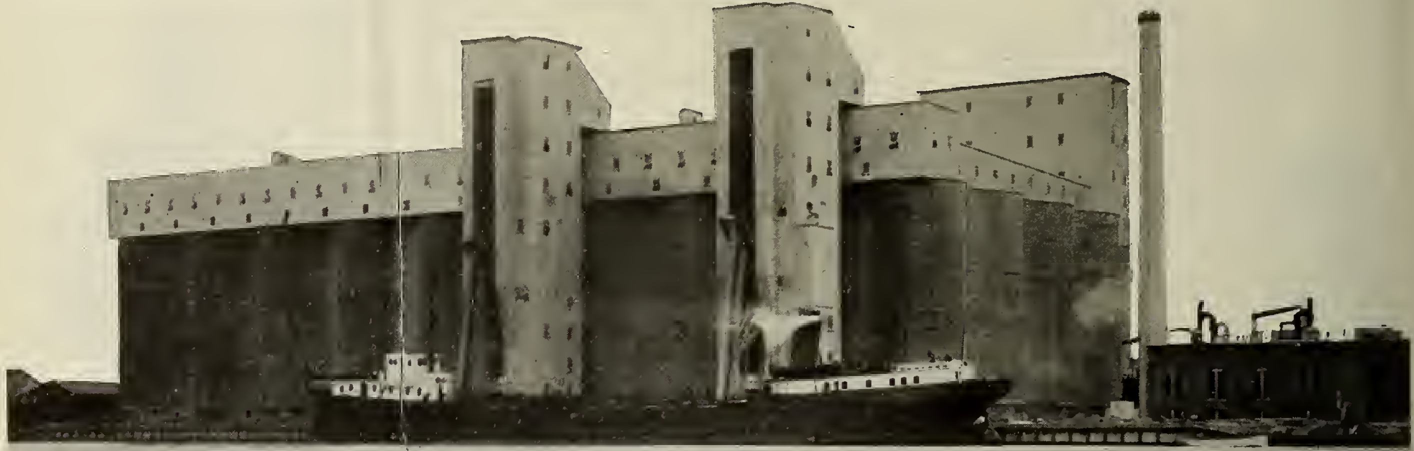
B TRADE MARK

All types and sizes of
Standard Machine and Engineers' Wrenches

Welland, Ontario



—built with Burlington Steel Bars

For the large extension made in 1912 to the C. P. R. Elevator at Port McNicoll, Ont., two thousand tons of Burlington Bars were used in the foundation and bin walls. The engineers were John S. Metcalf Co., Ltd., Montreal, to whom we are indebted for the above photograph of the elevator. Scores of other prominent engineers throughout Canada are successfully using Burlington Steel Bars.

Rounds, Squares, Flats, Twisted Squares, Angles, Channels, T-Bars, Ovals, Half Ovals, Half Rounds, Bands, and Special Sections; Cross Arm Braces; Pole Shims

Prompt Shipment from Stock

Following are just a few of the noteworthy contracts for which Burlington Steel Bars have been used:
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Grand Trunk Pacific Elevator—at Fort William, Ont.
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Section 2, Welland Canal—Baldry, Yerburgh & Hutchison.

BURLINGTON STEEL COMPANY, LIMITED, HAMILTON
FORMERLY "CANADA STEEL COMPANY, LIMITED"

Sash Weights
and
Cast Washers
Manufactured by
Fittings, Limited, Oshawa
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WELLS AND GRAY, LIMITED
Engineers and Contractors
Buildings and Construction Work
OF ALL KINDS
Reinforced Concrete a Specialty
Write us for preliminary plans,
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247 Confederation Life Building, TORONTO, ONT.

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CAST IRON PIPE

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Water and Gas Supply, Fire Protection, Road Culverts, etc.

30" Intake, floated to position before lowering

United States Cast Iron Pipe & Foundry Co.

General Offices:—BURLINGTON, NEW JERSEY

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Simplicity and Strength

These are the things that a Contractor demands of Dump Cars and the only way to get them is to buy

Bechtel Cars

Our Cars are strongly built and braced throughout and nothing to get out of order on them.

OUR LINE

Side Dump Cars
All-round Dump Cars
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Winding Drums
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Switch Points, Frogs and Throws
Brick and Tile Machinery
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Favor us with your inquiries.

Bechtels Limited Waterloo, Ontario

J.O.B. CONTRACTORS PUMPS

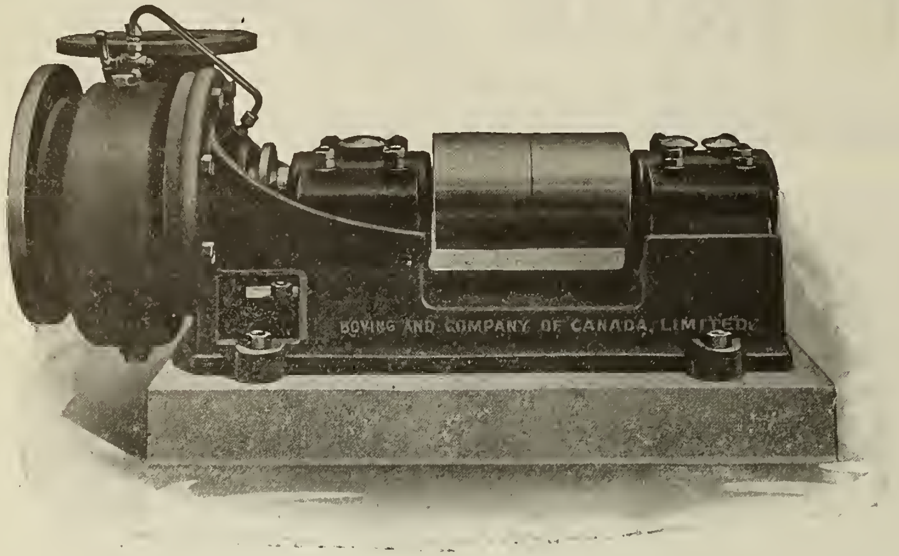

Illustration shows 10" Contractors Pump.

Belt Driven Low Pressure Pumps of Solid and Durable Design — Built for Heavy Duty.

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"INTERNATIONAL"
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It spells longer life, less repairs, no breakdowns, constant service, greater output, and lower operating and mixing cost. On the next job use the

"INTERNATIONAL"

Concrete Mixers

GLOBE TYPE

Some New Improvements worth investigating:

Globe Drum, Steel Tracker Bands, Self Oiling Winding Drum and Tracker Wheels, Steel Chain Drive

Write to-day for complete Catalog No. 60-98 and prices.

Large stock carried for immediate delivery

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MILWAUKEE, Wis., U.S.A. *Factory:* Cudahy, Wis.

10 sizes, 4 to 100 cu. ft. per batch. Any power.
Agents wanted in open territory. M325.4

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Book Department

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Lever Bros. Sunlight Soap Works, Toronto, Canada. The foundations of this building are below the level of the River Don and consequently subjected to heavy water pressure. The basements are dust-dry, however, as Ceresit was used on walls and floors.

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Ceresitized Concrete

The ideal building material of the 20th century

Concrete is the building material of the day. Its excellence fully justifies its tremendous growth.

CERESITIZED concrete is the ideal building material because it is completely and permanently waterproof. It is not affected by any condition of moisture, water pressure or weather.

Write for your copy of the 1914 "Book of Evidence" which gives the complete facts about Ceresit, the dependable waterproofer for cement.

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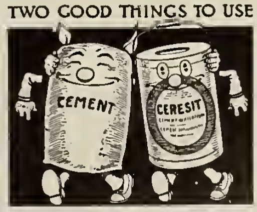


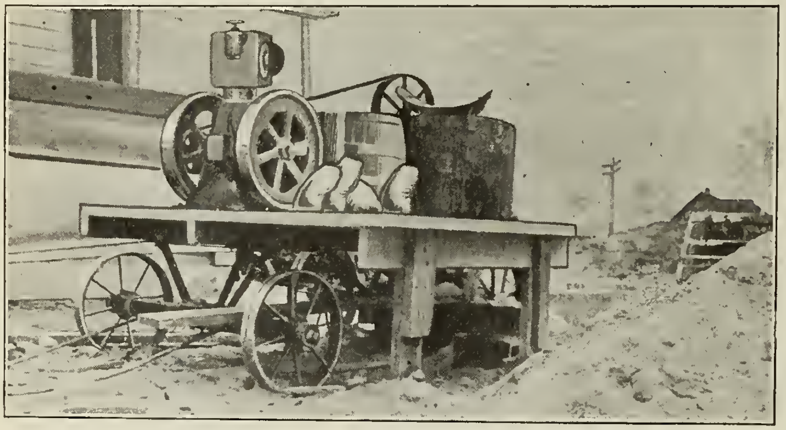
THEY GO WELL TOGETHER

Harding Mixer used on this Chicago Theater
Brown Mortar and neat goods used here

Have you written or wired for particulars of our Free Mixer Offer as explained in lastweek'sContract Record. 48 of the Patented Harding Mortar Mixers, the Successful Plaster and Mortar Mixer.

Brown Mortar and Scratch mixed on this Chicago church

To the first 48 Contractors only who write for this offer before Aug. 15th.



On Lincoln School House—Gould & Son, Contractor

Some of my Directors call this free mixer proposition "charity." **But I know better,** I know that this 48 will sell 150 more at regular prices within sixty days, and 500 in Canada for next season and that's what I want.

Read a few of the good letters which I have and you will believe as I do.

Read this letter

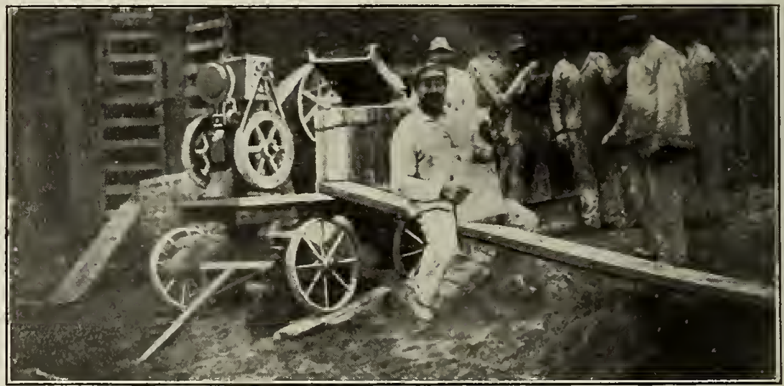
Gentlemen:—

Our friends advised us not to try to mix hair mortar with the machine, saying that it would stall our work and that we would have to go back to the boxes. The machine certainly made good. At times our two men were running through a sack a minute, with 36 shovels of sand to the sack. We mixed up to 49 sacks an hour. We had 6 men taking it to the hoist in barrows and 6 taking it away. Outside of labor we figured that we saved at least 10 sacks of material a day. The mortar is perfect and after it is on the lath it sets twice as hard. Mr. Mardis is interested in the machine and said that it would be just the thing for his brick, mortar and flooring work. You should be able to sell him. We told him we were using the first machine you sent us mixing Portland Cement on the Swift job. We will say a good word for your machines every chance we get. Signed,—Thatcher & Adair, Des Moines, Iowa.

Up to date the mixing machine still continues to do satisfactory work. Several parties are much interested in it. Signed,—The Thompson-Kirkpatrick Co., Philadelphia, Pa.

Enclosed you will find cheque for $225. The machine surely surprised me and all of us here. You should sell six more machines in this town soon, as a number of the other contractors have been looking at it. We have been mixing wood fibre (neat goods) and also with 42 shovels of sand to a two sack batch. Signed, —S. K. Jones, Cedar Rapids, Iowa.

Write now. You get our improved mixer free and all that we ask you to do is buy the engine and truck at market price of these articles.



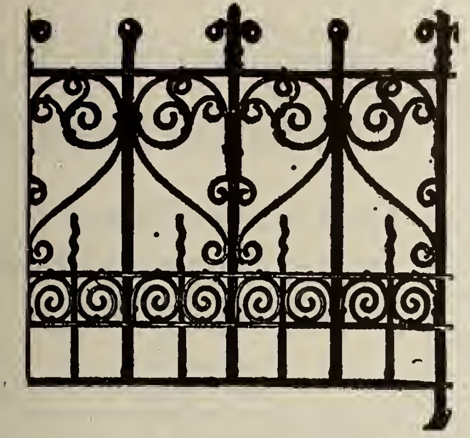
Showing 40-inch mixer on McNulty Job, Chicago
One man mixing easily kept six Hod Carriers Busy Carrying Away

Mortar Mixer Corporation - John B. Kemp, President

Iowa City, Iowa, U. S. A.

Agents and Dealers Wanted. **Valuable territory open. Act quick.**

Mixer fully protected by Canadian Patents thus protecting you in your territory. Big sale wherever introduced.



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Every conceivable style and design in ornamental iron fence work can be faithfully carried out by us.

Send in your specifications and get our quotations.

We also specialize in iron stair work.

The GEO. B. MEADOWS

Toronto Wire Iron and Brass Works Co., Limited
Meadows Block, Wellington St. W.
TORONTO, ONT.

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On plant of the Medina Foundry Co., Medina, O., J-M Asbestos Roofing has for years withstood a continuous shower of sparks from a cupola stack.

Scores of cases are on record to prove that J-M Asbestos Roofing has saved buildings from destruction by resisting the action of burning brands and embers blown from adjacent fires.

J-M Asbestos Roofing affords **excellent fire protection.** Fire, chemical fumes and weather have no effect on it—because it is all **mineral,** and therefore practically indestructible. Composed of layer upon layer of Asbestos Felt cemented with Trinidad Lake Asphalt. Literally a sheet of **pliable stone.**

Cheapest-per-year-roofing

J-M Asbestos Roofing contains nothing to rust, rot, peel or crack, Never needs coating or graveling. Its first cost is the only cost. Adapted to all buildings. Easily applied. Furnished in rolls and built-up form. J-M Roofing Cleats packed in each roll, make watertight laps and give the entire roof an unbroken, handsome, white surface. We ship direct if your dealer can't supply you. Write nearest Branch for illustrated Catalog.

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TORONTO MONTREAL WINNIPEG VANCOUVER

1966

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We have no affiliations or working acquirements with any of our competitors.

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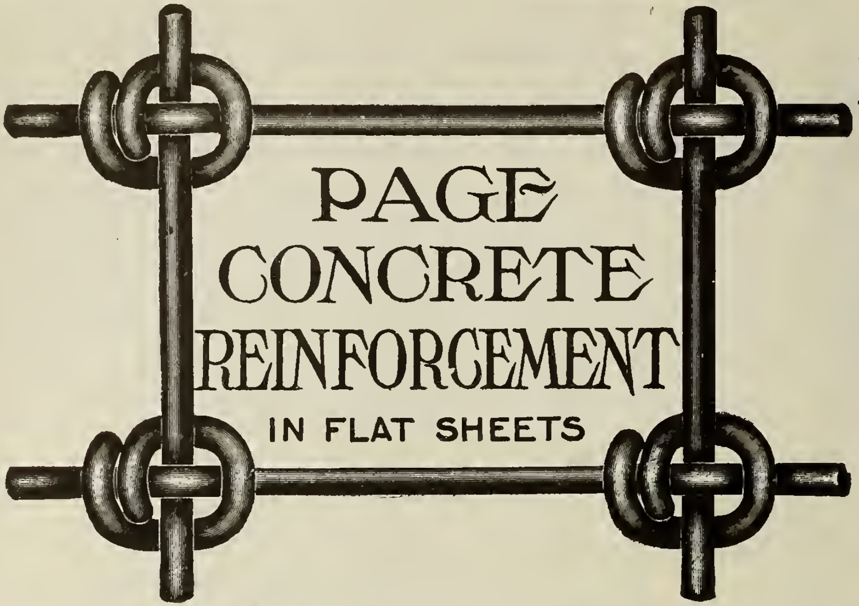

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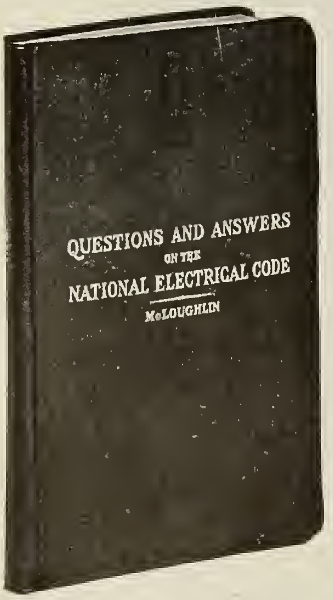

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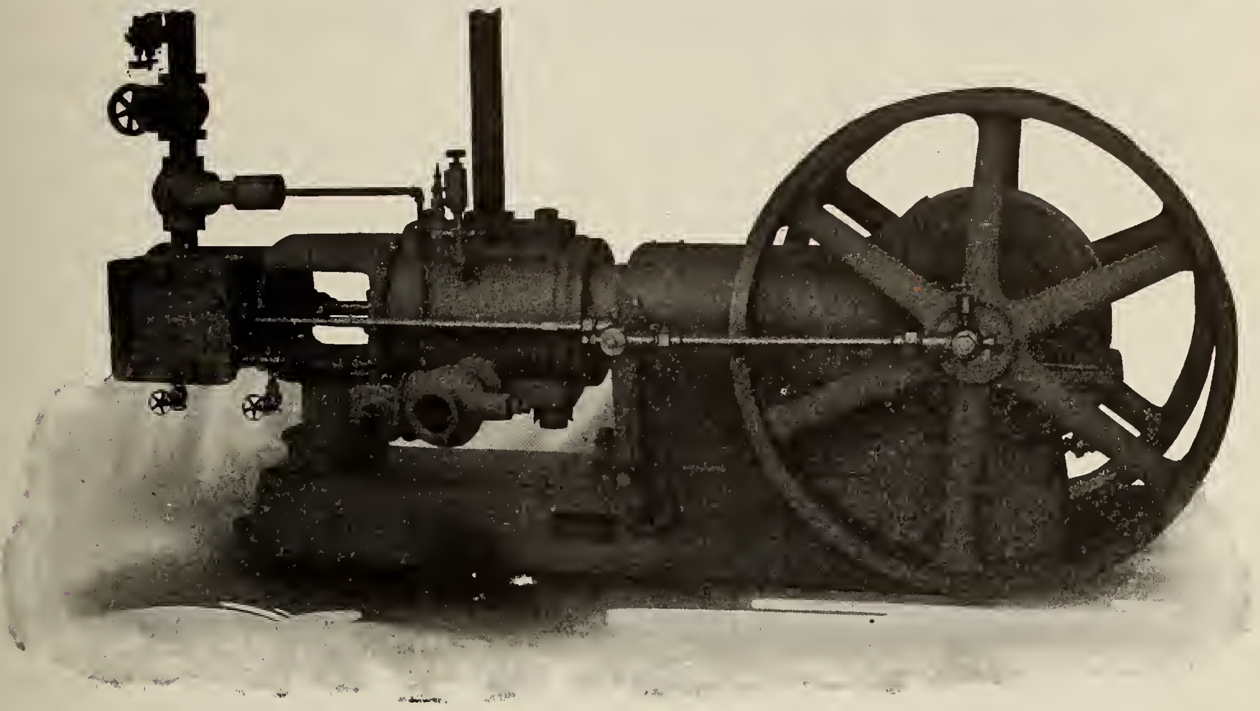

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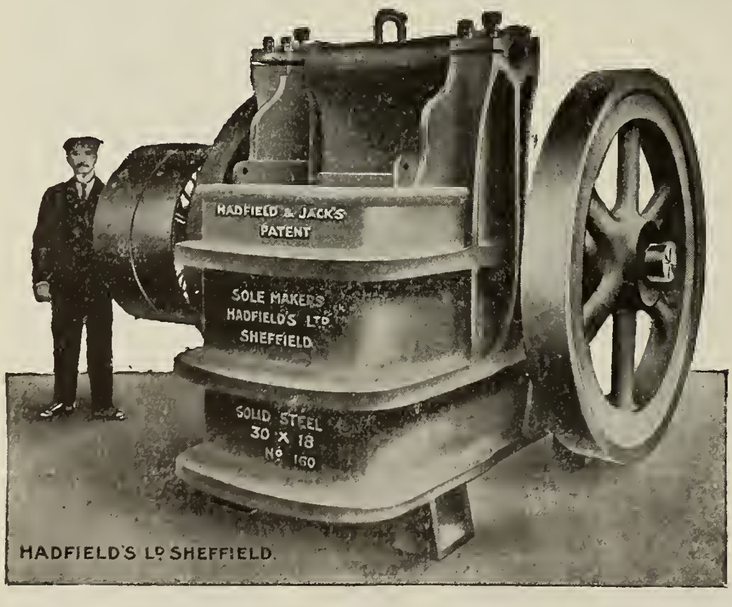
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Vancouver City Council's Unsavory Competition

MUCH has been said about the abuses of professional competitions and apparently much remains to be said. Objections have been brought forward, one by one, in many instances that we can call to mind, but it has remained for the city of Vancouver to provide, in one flagrant example, an embodiment of all the evils attendant upon engineering and architectural contests.

Last spring the Vancouver City Council invited competitive plans for the new causeway and sea-wall at Coal Harbor. This esplanade, leading to Stanley Park, affords a particularly attractive opportunity for the designer, the work suggesting a rare combination of the aesthetic with structural efficiency, and it is small wonder that the invitation to submit designs met with a generous response and that plans were received from twenty-three designers.

In the conditions sent out to the various competing engineers, the competitors were asked to provide sufficient details to enable the City Engineer, Mr. Fellowes, to check over the designs in regard to the strength and stability of the proposed work. It was stipulated that the designs should conform in line and grade with the plans supplied by the City Engineer. Competitors were requested to withhold their names from the plans, specifications and estimate. A clause was inserted to the effect that disregard of the conditions would entail disqualification. The rate at which the successful engineer would be recompensed was stipulated carefully.

These conditions are sufficient to show that the competition was in the palm of the City Engineer. With what amazement, then, do we now learn that the plans of the City Engineer have been approved and accepted by the Vancouver City Council—and this in the face of strenuous objection on the part of professional bodies in such high standing as the Canadian Society of Civil Engineers and the Architectural Institute of British Columbia, to say nothing of a united protest from the twenty-three competitors. From the evidence offering—and full details have been furnished by the Vancouver Office of this journal—we do not hesitate to commit ourselves unequivocally in condemnation of the fact that the City Engineer compiled the regulations governing the competition, assumed the part of technical expert in judging the designs and finally became a competitor, thereby, in the last-named regard, violating one of the essential parts of the competition.

It is inconceivable that any recognized body of men having a reputation to sustain should ruthlessly set aside the efforts of twenty-three designers after inviting them to compete and affording their own engineer the opportunity to get pointers from the designs. We do not allege that the City Engineer of Vancouver lent himself to such malpractice, but we do contend that the opportunity to do so was afforded him.

In defence of his own work and of the Council's selection, the Vancouver City Engineer urges that the modified plans submitted by him were conceived and prepared before he had examined the competitive designs, and that he had no previous knowledge of their structural arrangements. In this regard Mr. Fellowes' word must be accepted. But the explanation, such as it is, does not provide any excuse for the dishonest principle upon which the whole scheme of the competition is based. To allow a score of men to compete and incur expenses which might, in the sum total, well run into something like $15,000 to $20,000, is a piece of unconscionable filching (on the part of a city corporation) which in another guise might well come within the pale of the law. Such a violation of the conditions under which the competition was understood to have been conducted is a breach of confidence which one cannot extenuate. An experience of this kind is enough to set the faces of professional men throughout the whole country against competitions in general and particularly against work of any kind with which the city of Vancouver is even remotely connected.

The Vancouver Council called for a competition, and the conditions of that competition, stated or unstated, demanded that the plans should be submitted to a fully qualified and independent tribunal, so that the best plan would be selected and the winner at least have the honor of being placed first. The awards should have been made on the merits of the designs which conformed to the conditions set forth. After the award had been announced, the designer could have made any desired modifications upon a consultation with the City Engineer.

Seldom if ever does a contest pass without producing a few disgruntled competitors, but the Vancouver competition is in a class by itself. All the competitors, all the professional bodies, all honest men, apparently, are united in condemning the unsavory policy of the Vancouver Council. And all the protests are of no avail. The competition would appear to have been arranged merely for the sake of providing a secondary check upon plans which it had already been decided to accept.

This competition provides another instance of the need for the closer control of such contests by professional bodies. We cannot help thinking that in this instance the Canadian Society of Civil Engineers—collaborating, perhaps, with the Architectural Institute of British Columbia—should have appointed an expert to make a close scrutiny of the conditions by which the competition was hedged in. Had this been done, the loophole by which this injustice has been made possible would have been discovered. It should be compulsory for municipal bodies to submit conditions of competitions for engineering work to the Canadian Society of Civil Engineers. Without directing and controlling such, the latter body is not fulfilling one of its most important functions.

There can hardly be any redress. In all probability the united efforts of the twenty-three competitors—their brains, their labor, their time, their plans and their protests—will be unavailing. One can only sympathize with the hoodwinked "23" and offer them the same advice about competitions as Punch offered about matrimonial ventures—"don't."

Emergency Water Supply System for Montreal

Specially contributed by Frederick E. Field, Engineer in Charge

THE city of Montreal receives its water supply from the St. Lawrence River. An 8½-ft. concrete conduit laid in the north bank of the aqueduct brings the water from a point above the Lachine Rapids to the low level pumping station, a distance of about five miles.

On the night of December 25, 1913, this 8½-ft. conduit failed at a point where the widening of the aqueduct was under construction, and for eight days the city was practically without water, either for domestic and commercial uses or for fire protection.

The nature of the break in the conduit, the temporary repairs made, and the report of the Board of Engineers appointed to investigate this matter, have already been detailed in this journal and need no further comment.

Emergency Supply

On account of the crippling of the water supply occasioned by the break of December 25th, the city officials deemed it necessary to provide a secondary source of supply immediately, and on January 2, 1914, it was decided to construct an emergency water supply system from the Lachine Canal to the existing suction well at the low level pumping station and to have the work rushed day and night until completed.

The purpose of the new emergency supply system is two-fold: (1) to safeguard the city from a recurrence of a failure in its water supply while the work of widening the aqueduct is in progress; (2) to provide a permanent and ample secondary source of supply to be used in the event of any great conflagration or other emergency.

The general layout of the system is shown in Fig. 1. It comprises an intake chamber on the canal bank, about 1,300 feet of 8-ft. rivetted steel pipe encased in concrete, and a low lift pumping station adjacent to and connected with the existing suction well of the low level pumping station. The pipe-line crosses under two railroads and St. Patrick Street and over the River St. Pierre.

These crossings, together with the connections into the Lachine Canal and the existing suction well, provided interesting constructional problems, some of which will be described later in greater detail.

The capacity of this emergency supply system under the most unfavorable conditions—i.e., when the water in the canal is low and pumping is required—is 80 million Imperial gallons a day. Under normal conditions a greater supply of water may be obtained by gravity.

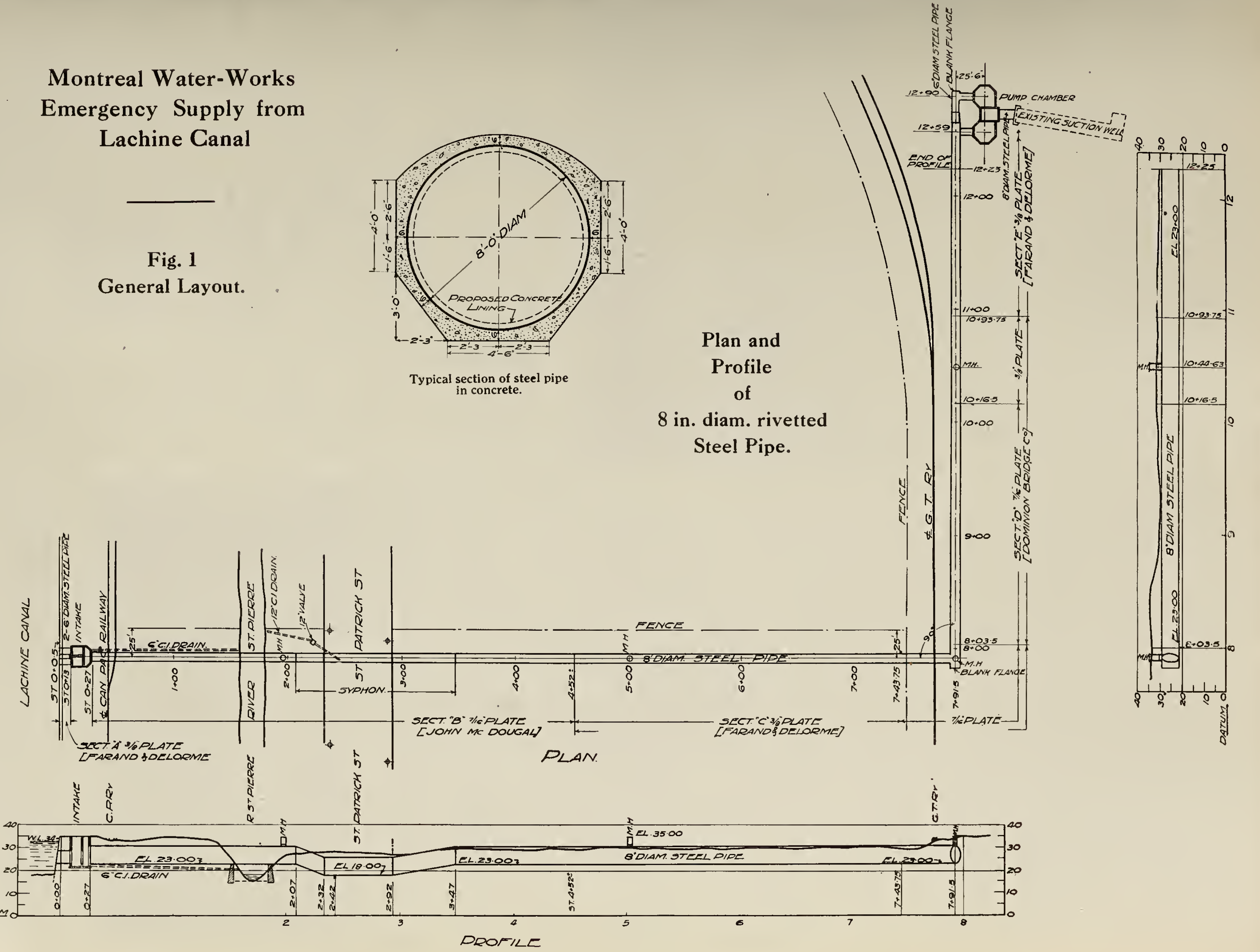
Intake.—The details of the intake are shown in Fig. 2 and the connections with the Lachine Canal in Fig. 3. Two 6-ft. pipes enter the intake from the canal, each being controlled by a 72 x 60 in. sluice gate. These sluice gates are of the non-rising stem type and are operated by removable capstan heads at the floor level. This type was required so as to have no structure above the level of the canal bank obstruct the tow-path or interfere with the loading or unloading of barges. Screens, not shown, are provided to slide in the stop plank grooves in front of each sluice gate.

A temporary crib was constructed in the canal about the entrance to the intake, as it was expected that the connection between the intake and the canal would have to be made without unwatering the latter. The canal was drained earlier than usual, however, to permit of necessary repairs and new work; consequently it was possible to complete the intake work under very favorable conditions.

Bridge.—Details of the crossing over the River St. Pierre are shown in Fig. 2. In Fig. 4 this crossing is shown after completion. It is an illustration of how an otherwise ugly structure, built solely for utility,

Montreal Water-Works Emergency Supply from Lachine Canal

Fig. 1
General Layout.



Typical section of steel pipe in concrete.

Plan and Profile of 8 in. diam. rivetted Steel Pipe.

may be made quite attractive by a small amount of inexpensive detail work.

Pipe Line.—The normal water level in the canal is less than one foot higher than that at present required in the existing suction well at the low level pumping station. It was therefore decided to use a pipe with an internal diameter of 8 feet, to minimize friction loss and permit of a gravity supply under ordinary conditions.

Eight-foot rivetted steel pipe was contracted for, as this could be obtained and laid more advantageously under the extremely severe weather conditions at the time the work was to be done. Figs. 5 and 6 show the pipe-line work during construction.

To preserve the pipe from destruction, it has been surrounded by six inches of concrete. The interior surface will be either painted or lined with cement mortar.

When not in service the pipe is to be kept empty by means of a 12-in. drain from the syphon under St. Patrick Street to the River St. Pierre.

Pump Wells.—The pump wells are two in number, each octagonal in plan, 18 feet in diameter and 22 feet deep, with 18-inch reinforced concrete walls. The two pump wells are separated by a central well which forms a continuation of the existing suction well. The 8-foot rivetted steel supply pipe branches off into two 6-foot pipes, one entering each pump well.

The flow of water from each pump well to the central and suction well is controlled by one 72 x 60 in. sluice gate and one 36-in. gate valve. Under ordinary conditions both of these are closed and the pump wells and 8-foot pipe-line are empty.

If the emergency supply is required, the sluice gates are opened both at the intake and in the pump wells, thus permitting water from the Lachine Canal to flow into the suction well. In case the water level in the canal is too low for a gravity supply, the 72 x 60 in. sluice gates in the pump wells are closed, the pumps started and the 36-in. gate valves opened, thus allowing the discharge from the pumps to enter the central well and pass on into the existing suction well.

Pumping Equipment.—In each pump well there is being installed a centrifugal pump of the submerged type with vertical shaft, having a capacity of forty million Imperial gallons of water in twenty-four hours against a lift of 5 feet. Each pump is belt driven by a 75 h.p. motor, working under 2,200 volts, alternating current.

Superstructure.—A red brick building with green

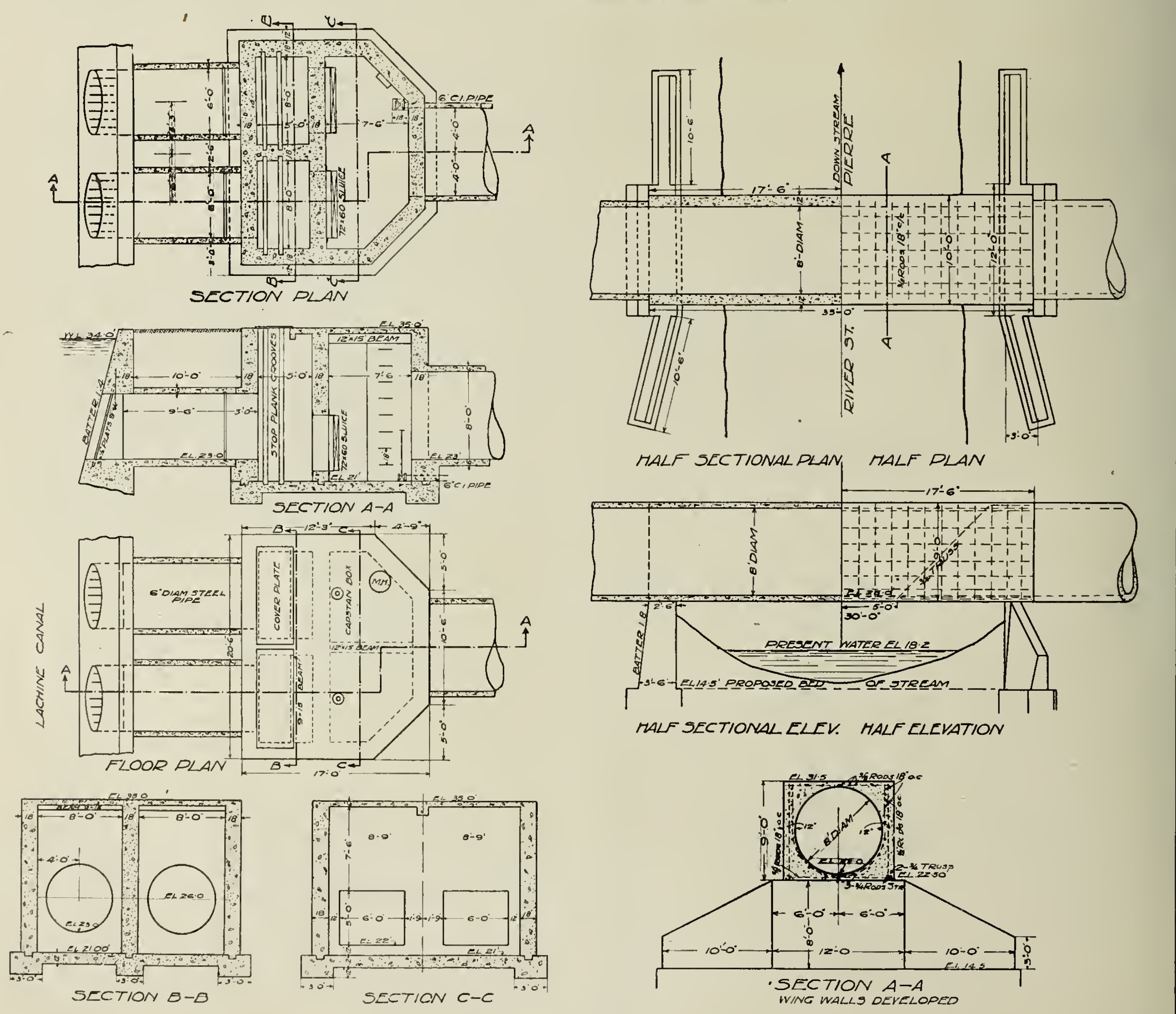


Fig. 2—Details of intake.

tile roof, laid on cinder concrete, will be built over the pump wells.

CONSTRUCTION METHODS

The methods of carrying on the work were influenced greatly by the severity of the weather conditions. Fig. 7 shows the maximum, minimum and mean daily temperatures as abstracted from the records of McGill College Observatory.

In January, 1914, the temperature fell below zero on twelve days and below 20 deg. on all but five days. The coldest day was on January 13, when the maximum temperature was minus 15 deg. and the minimum temperature was minus 27.1 deg. During this month 31.2 inches of snow and 1.11 inches of rain fell.

In February, 1914, the temperature fell below zero on eighteen days and below 20 deg. on all but two days. The coldest day was on February 11th, when the maximum temperature was minus 12.3 and the minimum temperature minus 26.9. The maximum temperature for the three days, February 11, 12 and 13, was minus 4.2 deg. During this month 14.9 inches of snow and .08 inches of rain fell.

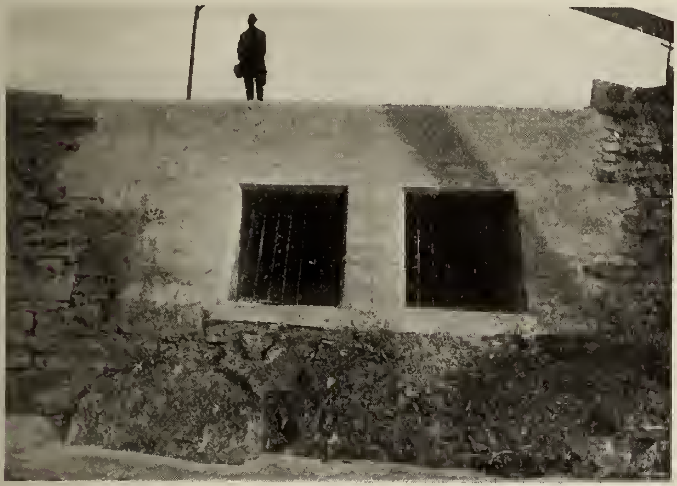


Fig. 3—Intake from Lachine Canal.

The averages of the daily temperatures for the three months are as follows:

	Mean	Maximum	Minimum
January, 1914* ...	12.29	20.1	4.3
February, 1914* .	7.41	15.1 minus	0.7
March, 1914* . . .	27.46	33.07	21.60

*Average of the mean of bi-hourly readings from self-recording instruments.

Organization.—As the work was to be carried on with all possible speed, the laborers were first divided into three shifts, each shift working continuously for eight hours without stopping for lunch; later, as the work approached completion, only two shifts were employed, and finally, after all piping and concrete work were finished, also backfilling, minor details, and cleaning up grounds, day shift alone was kept on.

Plant.—Three concrete mixers were installed. One was located at the pump wells and one half way between St. Patrick Street and the Grand Trunk Railroad, while the third handled the work between St. Patrick Street and the Canal.

Two stiff-leg derricks were used. One was placed near the pump wells and the other at the intake. These handled earth work, forms, piping and concrete.

An air compressor was located about midway along the line of pipe to supply air to the rivetting machines.

Two material sheds were erected, one near St. Patrick Street and the other at the pump wells. These were provided with steam heating coils (at the floor level) over which the stone and sand used for concrete were piled in order that this material might be dry and hot when transported to the concrete mixers. Steam, water and air piping were laid continuously along the entire length of the pipe line.

The 8-foot rivetted steel pipe was handled by means of three-pole derricks, spanning the pipe trench.

Pipe Laying.—As soon as the pipe trench was excavated, the sections of steel pipe were lowered into the trench and rivetted together in lengths varying from 15 to 24 feet. Coke-burning salamanders were then placed inside of the pipe, and the trench was thoroughly thawed out by means of steam lines. Tarpaulins were spread over the pipe and pipe trench to retain the heat and prevent freezing during the work of concreting about the pipe. This concreting was carried on as rapidly as conditions would permit. The weather was so cold that it was found necessary to house the concrete mixers, which were driven by gasoline engines.

The cement and the heated sand and broken stone were brought from the material sheds to the mixers by wheelbarrows. The material was mixed with hot water and then conveyed to the work by wheelbarrows. As soon as the pipe was concreted it was covered with tarpaulins, under which steam pipes were laid to prevent any freezing of the concrete.

Intake and Pump Wells.—The concreting of these was done in like manner, special care being taken to enclose the work with tarpaulins, provide sufficient heating coils to prevent freezing, and work as much as possible under cover.

The protective measures taken were entirely adequate and none of the concrete was found to be frostbitten, notwithstanding the extremely low temperatures.

Connection with existing Suction Well.—The making of the connection between the pump wells and the existing suction well was not the least interesting part of the work. The existing suction well is a reinforced concrete structure about 85 feet long, 10 feet wide and 24 feet deep, with a concrete arched roof. Through this suction well flows the entire water supply of the low level pumping station to a depth varying from 12 to 16 feet. As this suction well could not be drained without shutting off the city's water supply, the con-

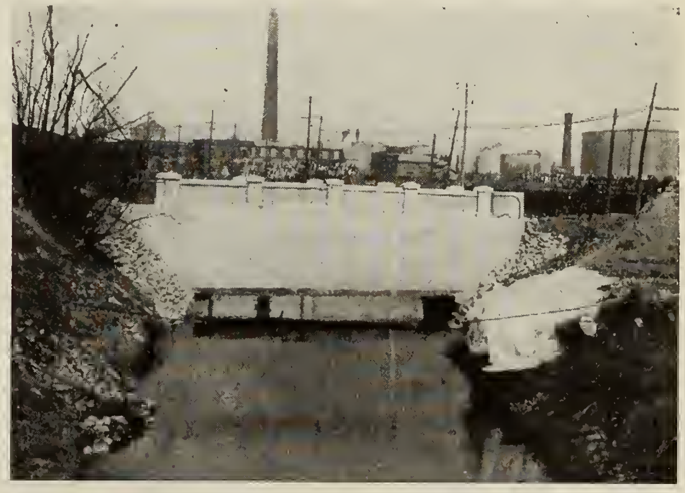


Fig. 4—Pipe crossing River St. Pierre.

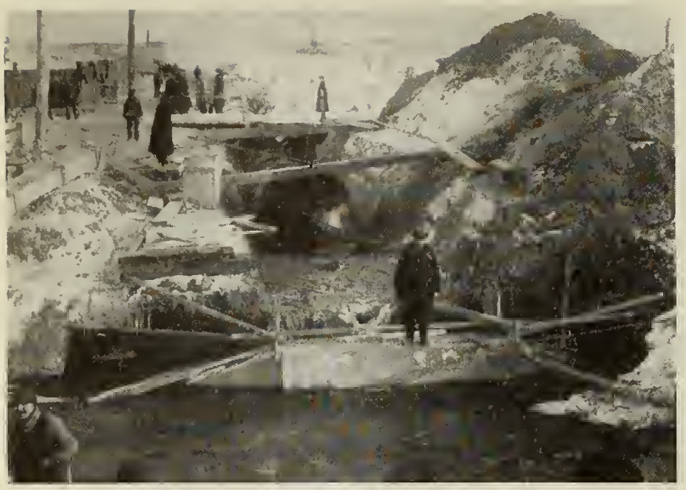


Fig. 5 - Pipe line near River St. Pierre.

nection had to be made with the suction well in service.

A diver was employed to place a timber bulkhead across the end of the suction well, leaving sufficient space between the bulkhead and the end of the chamber to permit of the end wall being cut through. This bulkhead was made up of 12 x 12 in. timbers weighted down by pig lead. Between each two timbers were placed two parallel pieces of 1-inch rubber hose, running the entire length of the timbers. When the bulkhead was completed above the water level, jacks were used to force the timbers down one upon the other and the pieces of hose were sufficiently compressed to act as gaskets and make the bulkhead practically water-tight.

The section of 8-foot pipe between the pump wells and suction well was then laid and surrounded by concrete. After this concrete was placed, an 8-foot circular opening was cut through the 20-inch reinforced end wall of the suction well by means of air drills. After this was done the pipe and central well were filled with water to balance the pressure on both sides of the bulkhead and the bulkhead was removed by the diver, thus completing the pipe-line from the Lachine Canal to the existing suction well.

Progress

Rapid progress was, of course, difficult on account of the extreme cold; moreover, the final completion was delayed from ten to fifteen days on account of failure to obtain the necessary official permission to cross the railroads' right-of-way. This interfered particularly with rapid progress on the pipe-laying.

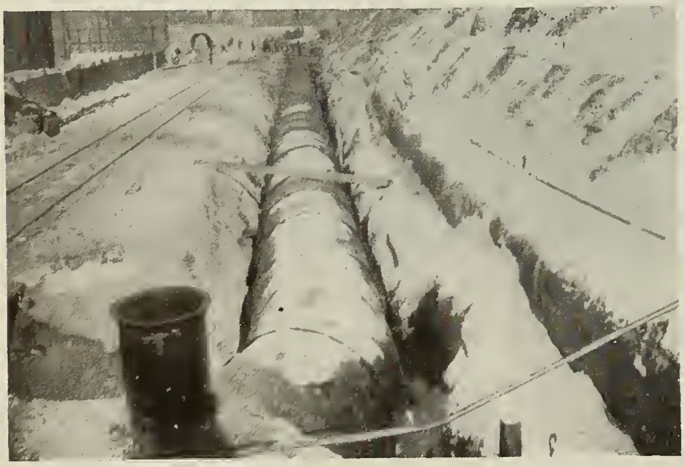


Fig. 6—Pipe line along Grand Trunk Railroad.

Taking all conditions into consideration the rate of progress was very satisfactory. This may be stated briefly as follows:

January 2, 1914.—Emergency Supply System from Lachine Canal decided upon.

January 8, 1914.—Orders given for first 800 feet of 8-foot rivetted steel pipe.

January 12, 1914.—Contractor started excavation of pipe trench.

January 15, 1914.—First sections of 8-foot rivetted steel pipe delivered.

January 25, 1914.—First sections of 8-foot pipe placed in trench.

January 29, 1914.—G. T. R. and C. P. R. driving piles for temporary stringers at pipe crossings.

February 3, 1914.—Contract awarded for two 40-million gallon pumps. Concreting about pipe started.

February 4, 1914.—About 600 feet of 8-foot pipe laid and rivetted.

February 20, 1914.—Pipe laid entire distance from intake to pump wells.

February 22, 1914.—Floor of pump wells completed.

March 6, 1914.—Concrete in pump wells completed.

March 12, 1914.—Intake concreted.

March 14, 1914.—All concreting about pipe from intake to pump wells completed.

March 22, 1914.—Section of 8-foot steel pipe laid between pump wells and suction well.

March 30, 1914.—Started to cut through into suction well.

March 31, 1914.—Erection of both 40-million gallon pumps started.

April 3, 1914.—Connection into suction well completed.

April 7, 1914.—Bulkhead removed from suction well and gravity system ready for service if required.

COST OF THE WORK

The cost of the work was naturally greater than would be expected under more favorable weather conditions. A close approximation may be summarized as follows:—

Rivetted steel pipe, furnished and delivered..	$ 32,300
Sluice gates, valves and c.i. piping	5,860
Two 40-million Imperial gallon centrifugal pumps with switchboard, motors and appurtenances	6,530
Structural steel for roof trusses and pumps.	500
Pay-rolls, covering earthwork, pipe-laying, concrete and miscellaneous work, on basis of cost plus 10 per cent.	74,565
Materials of construction, including cement, sand, stone, lumber, repairs to plant, etc., on basis of cost plus 10 per cent.	38,270
Rental of plant	2,400
Insurance of laborers	2,400
Superstructure of pumping station (estimated)	4,000
Miscellaneous (estimated)	675
Engineering and inspection (estimated)	2,500
Total	$170,000

Based on a minimum capacity of 80 million Imperial gallons a day, the cost of the construction of the Emergency Supply System is therefore approximately $2,100 per million gallons daily capacity.

WORK AND MATERIALS

The more important parts of the work were done by the following firms: Rivetted steel pipe.—Messrs. Farand & Delorme, the Dominion Bridge Company, and Messrs. John McDougall Caledonian Iron Works Company. Sluice gates.—Messrs. Coldwell Wilcox Company. Pumps and appurtenances.—Messrs. John McDougall Caledonian Iron Works Company. Construction work, including earthwork, pipe-laying and concrete work.—Messrs. Laurin, Leitch & Company.

LACHINE CANAL WATER FOR DOMESTIC USE

The water in the Lachine Canal is composed of the waters of the St. Lawrence and Ottawa Rivers, in varying proportions, due to climatic changes. Experiments covering a period of two years have shown that this canal water may be made safe for domestic use by proper chemical treatment. Provisions have therefore been made for the sterilization of this water supply when in use by treatment with a solution of hypochlorite of lime, which will be mixed with the canal water just prior to its entrance to the pump wells.

The public is therefore assured not only of an ample supply of water for emergency fire needs, but also that this water before its delivery into the supply mains will be so treated as to make it perfectly safe for domestic consumption.

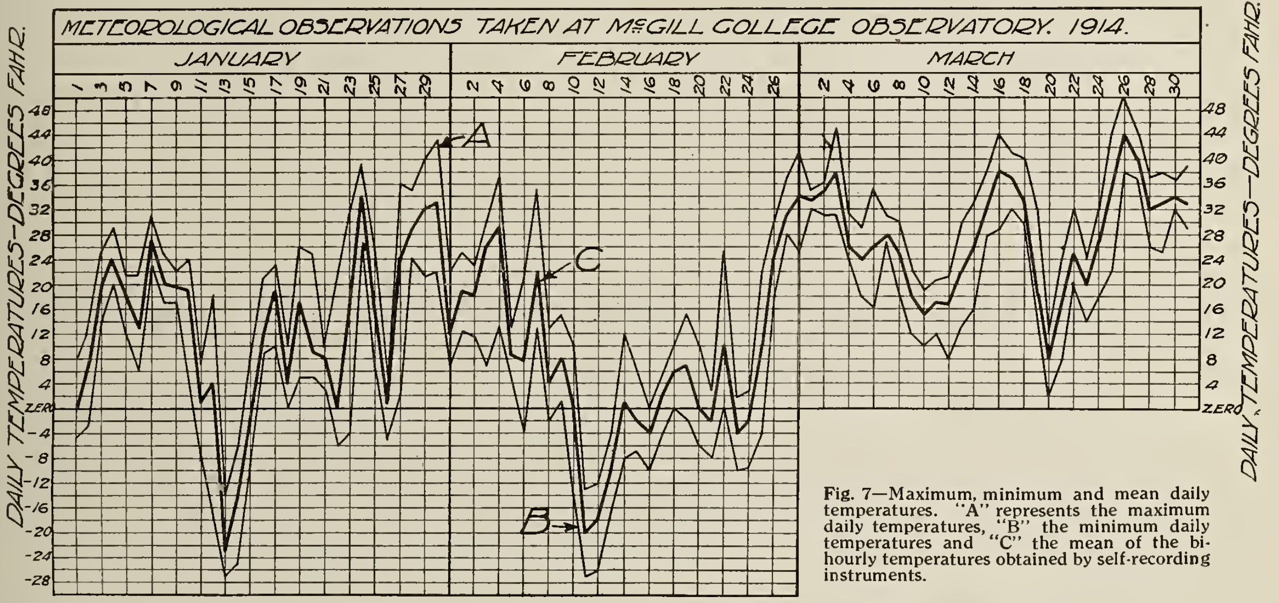


Fig. 7—Maximum, minimum and mean daily temperatures. "A" represents the maximum daily temperatures, "B" the minimum daily temperatures and "C" the mean of the bi-hourly temperatures obtained by self-recording instruments.

Hydrated Lime in Concrete Road Surfaces

By Robert S. Edwards

THE general conditions under which concrete pavements are placed are severe, as the majority of work is usually done in the dry spring and summer months when temperatures are high, causing excessive evaporation. The concrete is generally poured on an earth or clay sub-base in a thin slab varying between 4 ins. and 7 ins. in thickness. This condition alone makes it almost impossible to secure uniformity throughout the concrete mass, so that after hardening the concrete road slab is subject to far greater variation, due to the segregation of the coarse aggregate from the mortar, than is found in other forms of concrete work. This, of necessity, causes unevenness throughout the concrete, and the excessive cracking and unravelling so often seen in poorly laid concrete roads is directly due to this fact.

It is the writer's opinion that the primary cause of cracking in concrete pavements is due to the loss or leakage of varying portions of the mixing water from the concrete by seepage through the sub-base, as well as by evaporation from the surface of the concrete, which leaves the concrete road slab in such a condition that at later times it will alternately absorb and give up water, depending on the season of the year, and that expansion and contraction of concrete and any movement in its volume are due infinitely more to this alternate wet and dry condition than to any temperature change from hot to cold without presence of moisture.

That the cracking which is directly attributed to the change in the condition of the sub-base, either in settlement spots or in drying out in shrinking, is primarily due to this cause, which is greatly helped by unevenness and variability of the concrete mixture.

That there are extremely few, if any, concrete pavements. individual slabs of which can be considered entirely uniform.

The Use of Hydrated Lime.—Hydrated lime is a product formed by the addition of accurate quantities of water to known weights of freshly burned quicklime, the finished material being a flour-like powder of great fineness and covering capacity, having more than twice the volume of the same weight of cement in its dry state.

The use of hydrated lime as a void filler in concrete mixtures, and for rendering concrete mixtures more water-tight, dates back several years. Numerous tests show that a replacement of from 10 to 15 per cent of cement by hydrated lime in rich concrete mixtures does not decrease the compressive strength of the concrete after three to four months' time, and ultimately increases the strength and permanence of the concrete. It apparently makes but little difference as to its action as a void filler, whether the hydrate is manufactured from a dolomitic or high magnesia lime or a high calcium lime—it being necessary only to have a product which contains no free lime or unslacked particles. The proper hydration or dry slacking of lime reduces it to a finer degree of sub-division than can be accomplished by any mechanical means.

The amount of water required to convert the dry hydrated lime into a plastic paste varies from 50 to 70 per cent of the weight of the lime; while, to obtain a mortar of similar consistency with Portland cement, an addition of 25 to 30 per cent of water is required.

Unlike Portland cement, however, the addition of water to hydrated lime does not create any chemical reactions. There is simply a lime paste formed which holds its excess water for a long time. Upon the addition of small quantities of hydrated lime, amounting to 10 or 15 per cent, to the weight of cement used in concrete mixtures and the ordinary mixing of such mixtures, the hydrate, which has absorbed a large amount of water, corresponding to its weight, is thoroughly disseminated throughout the concrete mass, and, due to its fine plastic conditions, it is forced immediately into places in the concrete which the cement cannot reach.

Concrete, so mixed, on leaving the mixer, flows more readily into place and the coarse aggregate has much less tendency towards segregation in the concrete mass. In other words, the extremely finely divided condition of the moistened hydrated lime paste has increased, to a marked degree, the covering or spreading quality of the cement, and reduced, to a similarly marked degree, the friction between particles of fine and coarse aggregate.

This answers the question "Why does hydrated lime benefit concrete?" The action is purely a mechanical one, and can be compared to the oiling or greasing of a shaft or bearing. The property which hydrated lime has of absorbing and retaining large percentages of water offers a ready solution to the problem of finding a means for keeping and holding moisture in freshly poured concrete pavements until the slower-acting cement-hardening process can utilize it.

It is obvious that small percentages of hydrated lime, when added to concrete mixtures, in road work, will accomplish the following things:

1. Renders the concrete highly plastic and homogeneous, thus producing density and uniformity in the finished concrete. This condition adds much to the life and efficiency of the road because of the uniform resistance to wear and other stresses.
2. Keeps a certain amount of excess moisture in the concrete while setting.
3. Renders the concrete mass more nearly watertight, thereby preventing the alternate wetting and drying out of the finished concrete.
4. In large pieces of work, these properties given to concrete by hydrated lime would materially reduce the labor in spreading and bringing the concrete to a uniform surface which is of great importance in paving work.

*Extract from paper before the National Lime Manufacturers' Association.

Training Men in a Contractor's Organization

TRAINED men in any line of endeavor are a necessity—and likewise a scarcity—and as contracting is both a business and a profession the need of such men is emphasized. Anyone just starting into contracting has the need of trained men brought forcibly to him, while large construction companies always are on the lookout for men of this kind.

Men, to be of value, must be not only trained but ambitious and competent. Such men need only be known to be in demand, and can command large wages; for in the end these men are the cheapest. Their mistakes are few and inexpensive; and besides, from their training they are enabled to devise many new labor-saving methods. It is the cheap, inexperienced man that is expensive.

There is a need to-day for teaching engineering contracting in our colleges; for if contracting is a science, as is claimed by some, then it can be taught, and there is a growing demand among young engineering students to take up this branch of engineering.

However, a course in college and a degree will not make a contractor, any more than it will an engineer; but as in the case of an engineer, it gives a good technical foundation upon which to build, and supplies the means to fit a man quicker for his life work, as it allows the young man to profit from the experience of others, assimilating from others the results that would take years to obtain in his own career. The case is analagous to that of a man who spends months to calculate that he could secure in some handbook for a few dollars.

But whether a man has a college training or not, he must still go through the practical training in order to become proficient. Even if he never becomes an expert, at least he must be so well trained that his work will be efficient, and he can be relied upon by those who employ him.

This subject of training men is being given much thought and attraction in the twentieth century. Many of the large commercial organizations have come to realize the value of trained men—not only trained to their particular line of business or profession, but also to their own particular methods and systems; and they are therefore devising apprenticeships and training courses so as to no longer be dependent upon chance to pick up efficient men.

The railroad companies are also beginning to realize that it is necessary to train men, instead of waiting many years for men to get the experience that will fit them for operating officials. Within the past decade one of the ablest railroad financiers and organizers came to the conclusion that it was the wrong principle to wait until a man became 45 or 50 years of age before he was competent to be made a superintendent, for he may then have only from 10 to 20 years of usefulness before him. So this man began to experiment with picked young men, to try to train them for such positions in from three to five years, so that they might become operating officials, and possibly more efficient ones, before they are 30 years of age, when they have before them a career of from 30 to 40 years. Not every man selected stands the training, nor do all who go through the course measure up to the standard; but the venture may be termed successful and the results obtained have justified the methods to such an extent that other roads are copying them.

One mistake sometimes made by organizations that are now training men is to take it for granted that a large per cent of the young men selected will not make good; and going on this principle but little help is extended, so that many actually do fail. Thus money must be expended to train or partially train a much larger number than is needed. It may not be wrong to tell the young man starting that the majority fail, as this may act as a spur to him and put him on his mettle to make good; but it is absolutely essential that these young men be not only trained but assisted and guided and a watchful eye kept on them. Man has never devised a machine that did not need some attention in order to keep it running; and so it is with the human machine—if success is to be obtained, watchfulness and attention must be the price paid.

As it is possible to train men in commercial lines and in railroad operation, so it can be done in the contracting field, and men can be made efficient managers within a comparatively short time.

First, there must be a standard set for the selection of the men to be trained. Such a standard need not necessarily be high as to education, although the broader a man's education, the more likelihood of his being successful. However, the standard should be high as to the applicant's character and natural ability. As a rule the man should be unmarried, of good health and habits and of a bouyant disposition. But hard and fast rules for selecting must be deviated from at times; for the exceptional man will appear, who if accepted may prove quick at learning and be ready to take up difficult tasks many years before others can be trusted to undertake them.

The contractor doing a limited amount of work can train men just as well as those operating on a large scale; in fact, better, for the young men will come directly under his care, and not be trained by a subordinate who may have little interest in the proposed scheme. He, too, is as much in need of trained men as his larger competitor, especially if he hopes to expand his business.

It is useless to train men and then not treat them so as to retain them in the organization. The course that they are put through will make them valuable in a much shorter time than if they "just growed" as Topsy did; hence if they can earn money much more quickly for their employer, they themselves must be paid salaries commensurate with their earning power. Many contractors seem to overlook this fact, gauging the salaries they pay, not so much by the earning power of the employee but rather by the salaries others pay men of about the same age and years of experience. Thus as men are trained and become valuable they leave to go with other contractors who are willing to pay according to the value received from their men.

One firm of contractors that has advanced by rapid strides within the last 10 or 15 years owes much of its success to the fact that the head of the firm has the ability to select good men as managers, and he pays such salaries as to attract them, and as they come to know his ways and methods, and prove their value to him, he keeps their salaries at a high standard, until to-day he has a larger staff of high salaried men and is paying higher wages than almost any contractor in the country. This really accounts for his success. By keeping his men satisfied he has held the same staff for years. The earnings of such men more than offset their salaries.

The selection of a course of training will vary somewhat with each contracting organization, just as the courses for the same degree vary in our leading colleges, but the general studies and methods can be the same.

First of all, the man to be trained must have some knowledge of mathematics. The more training and the greater the knowledge he has received in this line, the easier will be his other work; for applied mathematics is the foundation of all professions except those of belles lettres. Arithmetic, proportion and algebra are absolutely essential, while geometry and trigonometry will be found a great advantage in solving many problems. Elementary mechanics should likewise be studied, and the general principles of electricity. If the applicant has not had this course of training he should be sent to a night school, put under a private tutor, or given a course in a reliable correspondence school.

If anyone should ask the writer upon what side of contracting most contractors are weakest, he would not hesitate in saying the clerical or office end. Therefore, he would start the young man in that part of the work. The accounting should be the first thing to tackle. He should not only be taught the methods, but the reasons should be shown for using these methods. The routine work is the small part; he must obtain a clear understanding of the entire system. From this he should be given the test of making up special reports, to show the application of all clerical work. The gathering of such statistics will give him a comprehensive knowledge of the entire subject of contracting. This once obtained, he will be able to take in the details much better, and this recording and rehandling of the details will then be the next step.

The writer knows that many will differ with him as to this; but from experience and a close study of successes and failures in contracting, the writer does not hesitate in asserting that those trained in the general principles first and then made to cover the details, get a broader and more comprehensive training and their rise is more rapid. It must be remembered that the training of clerks and bookkeepers is not being considered—these start with the simple details and work up; but rather the men who are to handle important contracts, the future general managers and partners.

The next task should be the time keeping, the making up of payrolls, the handling of the workmen's individual accounts, and the actual paying off of the men. This will bring the beginner into first close touch with the vast army of industrial workers. He will get to know these men from their worst side—the grasping of money, whether it has been earned or not; he will learn the petty deceits, and the frauds practiced by foremen to obtain money for themselves, both from the contractor and his employees. He will be impressed with the importance of having these things correct and of keeping the men satisfied. In all of this work supervision must be given the man, but he must be placed on his own resources and made to rely on himself. He should be taught not to worry his superiors with useless questions, but to find out things for himself; but it will be well to explain to him the underlying principles of everything he is given to do.

At this stage he should be shown the importance of supplementing his work with reading. He should follow articles in the contracting and engineering journals, the proceedings of societies, and read books covering contracting and engineering in a general way. This reading should be kept up the rest of his life; and later when he gets to handling construction work, he should read books on the various classes of work being done, as concrete, excavation, sewers, railroads and other construction. These books should be referred to from time to time.

After time keeping, he should handle cost keeping, and the collection of all cost data. Then he should be taught the analyzing of costs and the use of cost data. This will give him an insight into estimating and the methods of doing work and the building up of a contract system and organization. He will learn of the various classes of work, their units, the sequence of events in carrying on construction, and many other details that will prove of value in the next steps of his training.

From cost keeping he will go to the first work that will bring him into intimate touch with actual construction, that is, the handling of supplies and materials. He will receive and check materials and supplies. In doing this, more so than in cost keeping, he will learn prices and see the need of closer buying. He will learn of wastes and how to prevent them. He will, if he keeps the proper records, get to know how much of each kind of supplies are needed weekly or machines and different classes of work. He will begin to learn of the care and repair of machines and tools.

In handling materials he will learn that the work of men is dependent upon receiving regular supplies of the materials, of the proper storage from the weather and to prevent them being rehandled uselessly. He will be brought face to face with executive problems, and not only how they must be solved but how to devise expedients to overcome unexpected delays and difficulties. He will now be an important part of the organization, the success of the entire job depending upon him. In receiving and handling the supplies and materials he will have his first experience in handling the men and teams that must work under his direction. This will be valuable experience for him, for he will get to know men, and as his forces will be scattered and difficult to watch he will need to use his head to keep them busy and know they are following instructions. This might be termed his preliminary training and it will cover a period of from one to two years.

The next step begins the real training for construction work. A small ditch has to be excavated to let off some rain water, or some similar job needs to be done, and the young man is given a small crew of men and set to work as foreman. This done, he is sent with his crew to assist some foreman, and he becomes a sub-foreman. Here he learns to obey, for no man is fitted to command others until he has learned obedience himself.

From sub-foreman he is sent with an extra gang to do odd jobs, his men being changed frequently so he will learn that different individuals must be handled in a variety of ways. From extra gang, he is given the foremanship of a gang doing some hard, monotonous work, where he will experience the daily routine grind of doing some difficult task, that will ordinarily take the heart out of the average man.

Then as occasion arises he can be given a job where he may have to handle several forces and rely much on his own judgment. Thus by changing from job to job and from one class of work to another he will gain experience under different general managers and on various kinds of work under many different conditions.

On some new job he can be sent out as assistant to the man who is to run the work. Here he can help to plan the job, organize the forces, assist in buying machines, materials and supplies and learn much that will benefit him. From this he could be given some small piece of construction to start and superintend himself, where he will have to keep his time and cost keeping, do his bookkeeping and buying, run his gangs, and in fact be everything that a small contractor must be, in order to make both ends meet. Here will be his supreme test; and if he makes good he will go on with his work, working mostly under others, unless he shows exceptional ability, until he learns how to estimate, plan out jobs and start them, and finally take charge of large undertakings.

Many young men selected will fall by the wayside. Some will have to be dropped soon, others will never get beyond the office work, making only good clerks; others will master these and some of the outside details, while a few will go through the entire course, making first-class trained men and amply repaying for the time and money spent on all of them.

The Results of Hypo-chlorite Treatment of Water

IN a paper read before the Illinois Water Supply Association by Mr. C. A. Jennings, it is shown that 600 cities in the United States are using hypochlorite for water sterilization. It is further shown that no city following a proper procedure has found it necessary to discontinue its use. Where poorly designed plant and improper working have led to trouble the method has, however, fallen into undeserved disrepute. It has sometimes been assumed that the application of hypochlorite would remedy a condition quite outside the sphere of its usefulness.

Statistics were quoted in this paper showing the results obtained at eight American cities where hypochlorite sterilization has been adopted. Of the eight cities the maximum reduction in the typhoid death-rate was 72 per cent at Cleveland and the minimum 35 per cent in Baltimore. The average reduction was 51 per cent. The total population considered was 2,033,000, with a reduction per 100,000 population for each year of 15.8 deaths.

At Baltimore, hypochlorite treatment of the water was started in June, 1911. Here the death-rate from typhoid fever was 35.2 per 100,000; during the period from 1900 to 1910 this death-rate fell to 22.8 per 100,000 in 1912-1913 after using hypochlorite. At Cleveland, where the treatment started in September, 1911, the death-rate fell from 35.5 during the preceding ten years to 10.0. At DesMoines the treatment was started in December, 1910. Here the death-rate fell from 22.7 during the preceding five years to 13.4. At Erie the treatment was started in March, 1911. The death-rate in this case fell from 38.7 in the preceding ten years to 13.5. At Evanston, where the treatment was started in December, 1911, the death-rate fell from 26.0 during the preceding three years to 14.5. In Jersey City the treatment was started in September, 1908, and the death-rate, which was 18.7 during the preceding seven years, fell to 9.3. At Kansas City the treatment was started in January, 1911, and the death-rate fell from 42.5 during the preceding ten years to 20.0. At Omaha the treatment was started in May, 1910, and the death-rate, which was 22.5 from 1900 to 1909, fell to 11.8. Such are the beneficial results of water sterilization in America.

The supply main leading from the terminus of the Weston aqueduct of the metropolitan water district, Boston, toward Chestnut Hill reservoir, which was laid in 1902 and 1903, has been cleaned for a distance of 6,800 ft. at a cost of $384.25, or $0.056 per foot. The tubercles were removed from the interior of the pipe by laborers using wood and iron scrapers, and the pipe was then washed by the use of a spraying machine, using a jet from a ¼-in. diameter nozzle under a pressure of 200 lbs. per square inch. The lighter material was washed out of the blowoffs, and 45 cu. ft. of the heavier material, composed principally of tubercles, were removed in pails. The work is described by Dexter Brackett, chief engineer of the Metropolitan Water Board, in his annual report for 1913.

Making Railroad Fill from Pontoon Bridge

HALF way between Winnipeg and Port Arthur it was found desirable to locate the main line of the Canadian Northern Railway across an arm of Rainy Lake. It was decided to make a rockfill for the crossing, which was 3 miles long, and in order to avoid the necessity of driving piles to support the work trains a special pontoon arrangement was devised.

Surveys for determining the nature of the permanent construction were started in 1908, and it was found that the depth to rock bottom was so great that the piers for a series of steel bridges would be very costly. The mud overlying the rock was too soft to hold clusters of piling, but was also pronounced too stiff to allow rock-filled cribs to sink to foundation.

Study of Lake Bottom

Study of the lake bottom was carried on through the ice for two winters, and was then finished on open water by what is said to have been a more satisfactory method. The summer soundings were made from a 22 x 34-ft. barge with a driving machine over a central well opening. A 70-lb. hammer was used to sink extra-heavy 1¼-in. strain pipe to refusal. This pipe was joined together in 10-ft. sections by threaded couplings, and steel specials for point and cap were provided. As many as twenty-eight soundings in a day were taken with this equipment.

With this detailed information about the lake bottom at hand, it was decided to make a solid rockfill for the entire crossing. When the most economical projection of the line across the water had been determined, it was found that the fill would have to be more than 60 ft. deep in some places and that a total of about 1,000,000 cu. yd. of rock would be required. Quarries were located on company property near the lake shores, so that an average haul of only 1 mile was necessary. The line was located so as to take advantage of five rocky islands along the route, and of course rock from these was used in starting fills out from their shores. In October, 1910, two model C 95-ton Bucyrus steam shovels were put to work loading broken rock into 12-yd. standard-gage dump cars, and two more were added a few months later. All four shovels were in commission until the fall of 1912, and during this time each sometimes handled as much as 50,000 cu. yd. of rock per month.

Floating Track Over Dump

One of the difficulties encountered at the outset was the necessity for some method of dumping the rock so that it would give no trouble in settling into the desired position. A very satisfactory solution of this problem was devised in the shape of a dumper consisting of two 6-ft. plate girders 30 ft. apart, with floorbeams 30 ft. apart on the end at which dumping was done, and shorter distances apart for the remainder of the truss. The track was supported on stringers at the centre, leaving distances of 11 ft. between girders and the ends of the ties through which the material was dumped. Originally the girders were 120 ft. long, but they were afterward lengthened to 140 ft. so as to carry six 12-yd. cars at one time.

The support for the truss, 75 ft. from the embankment end, was a 32 x 112-ft. barge capable of carrying 200,000 lbs. for each foot of displacement. When not resting on the head of the bank, the shore end was supported by two pontoons placed about 40 ft. apart. A girder with a portal entrance and bracing carried the weight from the shore end of the dumper to these pontoons. The truss was supported on the main barge by cribbing so that it could be raised or lowered according to the height of the finished embankment above water. For the most of the work this was about 15 ft. above the lake surface.

At each end of the barge were capstans from which lines ran out nearly perpendicular for nearly 1,000 ft. to the shores of small islands or to a 5-ton anchor block of stone. A forward line was carried from a winch on the barge and used for warping the barge in moving forward.

Two heavy saw logs were attached to the shore end of the barge, with the small ends toward the shore, so that they formed a support for the track until the head of the bank was brought entirely up to grade, usually a distance of not more than 2 ft.

Dumping could generally proceed until the top was within 2 ft. of grade before it was necessary to move ahead. When the dumper was first built it was anticipated that about 1 hour would be required to move the device, but in actual practice only 3 or 4 minutes were needed, and dumping could proceed as soon as the track was laid over the space left vacant on the head of the bank. Usually the whole operation consumed about 15 minutes.

When the fill had been brought up sufficiently near the surface the floating bridge was moved ahead and the widening and finishing up of the grade was left to be done by side dumping. About one-third of the grade was usually added in this way after the floating bridge had moved on.

In closing up the work the gap finally became too short to permit the use of the barges supporting the dumping track. The embankment was then gradually advanced from the east until the gap was short enough so that the 140-ft. steel girders could be floated in on the main barge and bearings secured for them on opposite faces of the two approaching fills. The girder ends were then blocked up on the rock and the barge towed out. After the rock voids near the girder supports had been well filled and allowed to settle, the dumping was proceeded with as before from the track on the girders. When the girders were no longer necessary, they were dismantled and removed.

As to the operation of the dumper, the contractors report that there was no delay from the time the dumper was first installed, except once when the rock embankment settled quickly and for a short time there was danger of a locomotive and cars going into the lake. The dumper was carried when empty by the main barge and pontoons so that there was never any danger of it sinking. The entire cost of the dumper did not exceed 1½ cents per cubic yard for the amount of work done by it, and the equipment is in practically as good shape as when constructed.

The fill was made by Johnson & Carey, subcontractors, under Foley, Welch & Stewart, general contractors for the Canadian Northern Railway. E. S. Johnson designed the dumper specially for the Rainy Lake work and has obtained a patent on the device, the superstructure of which was constructed by the Minneapolis Machinery Company.—Engineering Record.

Tanneries and glue works in the metropolitan sewerage district of Boston all have settling tanks of substantial size. This method of treatment, according to the 1913 annual report of Frederick D. Smith, engineer of sewerage works, has very greatly reduced the amount of sludge material entering the metropolitan sewers and has materially lessened the cost of maintenance of the sewers in this district.

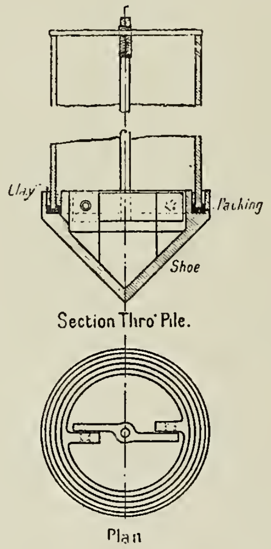
A New Concrete Piling

Semi-Moulded, Semi-Liquid Process Filling All Voids With No Driving

The Engineer

HITHERTO two systems of concrete piling have been in vogue. In the first the pile is moulded, allowed to set and then driven in the ordinary manner. In the other, a steel tube is driven into the ground, then filled with concrete and afterwards withdrawn, the concrete remaining in place. Both systems, in the opinion of many engineers, suffer from defects. In the one case the concrete pile may, they contend, be injured in the driving operation, while when the tube is employed they hold that it is impossible to be certain that the concrete fills the whole space vacated by the tube when it is withdrawn.

A NEW CONCRETE PILING.



Fi . 1
Shoe Attachment.

A system of concrete piling which has been recently designed to overcome these defects, may be described in general terms, as a combination of the two existing methods. First of all a steel tube provided with a shoe is driven into the ground. This tube is then partly filled with concrete in a semi-liquid condition, and a moulded concrete column or pile is introduced into the tube. This may either descend down to the bottom of the tube by its own weight, or force to make it do so is applied if necessary. Simultaneously, the tube is drawn up and the concrete pile remains with the semi-liquid concrete filling the whole of the space originally occupied by the tube and intimately surrounding the concrete pile as well. It will be seen, therefore, that the result is the formation of a concrete pile which is at any rate of the same diameter as the tube—and it may, in parts, be greater, if the ground be soft—while there is certainty that every particle of space is filled with concrete because the weight of the pile itself, in addition, perhaps, to the force used to bring the pile down into position, has ensured this. Moreover, the pile has not had to be driven, in the ordinarily accepted meaning of the term, the forcing process requiring only a steady pressure, which is very different in its effect on the head of the pile to that produced by a falling ram.

The inventor has designed special means for making the joint between the shoe and the tube water and sand-tight, as shown in Fig. 1. Two kinds of packing are used in each joint. One of these is of a fibrous nature, and the other, which is on both sides of the fibrous packing, is plastic, and may be ordinary clay. This packing entirely prevents the entrance of water or sand, so that the tube may be driven down through water without the latter finding its way into it.

Fig. 2 gives sections showing what happens when one of the piles is driven. The left half section of this drawing shows the tube driven into the ground and partly filled with liquid concrete. A cast concrete column has just been lowered on to the top of this liquid concrete. It will be observed that for the bulk of its length this column is of considerably less diameter than the tube, but that it is provided with a collar or flange, which is an easy fit within the tube. As the column descends the liquid concrete displaced by it must necessarily rise in the tube, and it does so until it meets the collar, which it finds some little difficulty in passing, so that pressure is set up. In this way, when the tube is withdrawn, the concrete is forced into the space up till then occupied by the tube. Ordinarily, the flange or collar will be arranged so that when the column is in its final position the collar may be just about at ground level. The position of the column and its flange when the former has reached the bottom of the tube is shown in the right-hand half section of Fig. 2. In this drawing two things will be observed. The first is that the shoe remains in the position into which it has been driven, and forms the foot of the pile, and the next is that the beneath-ground

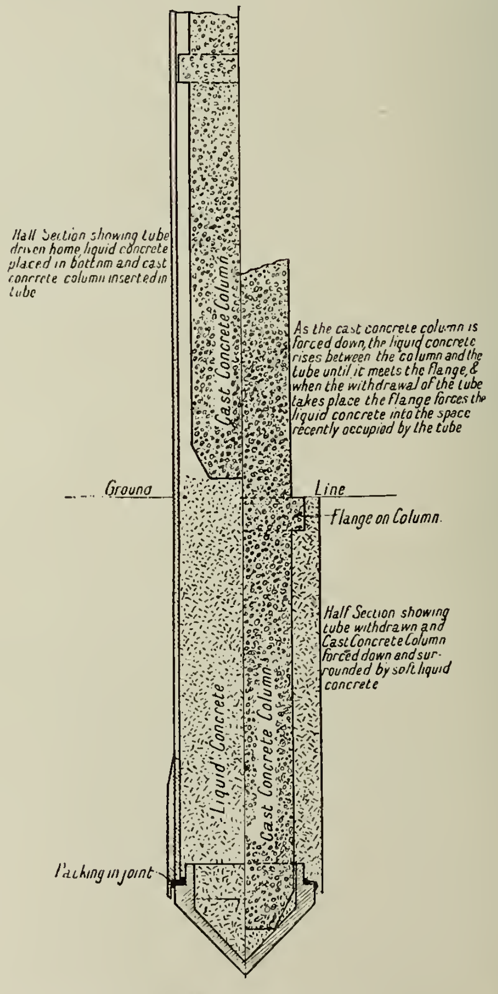

Half Section showing tube driven home liquid concrete placed in bottom and cast concrete column inserted in tube
Cast Concrete Column
As the cast concrete column is forced down, the liquid concrete rises between the column and the tube until it meets the flange, & when the withdrawal of the tube takes place the flange forces the liquid concrete into the space recently occupied by the tube
Ground
Line
Flange on Column.
Half Section showing tube withdrawn and Cast Concrete Column forced down and surrounded by soft liquid concrete
Liquid Concrete
Cast Concrete Column
Packing in joint

Fig. 2—Half section, showing operation.

portion of the pile is of considerably greater diameter than is the concrete column or even than the collar upon the column.

Occasionally it may be found that the concrete column will go right home by the action of gravity alone. Generally speaking, however, better results are obtained by means of a device which forces the column down and at the same time withdraws the tube as well.

As the pile descends and the tube is raised, the semi-liquid concrete rises and surrounds the pile and occupies the space taken up before by the tube. A flange on the pile after a time acts as a baffle or rammer on the top of the semi-liquid concrete, and assists in consolidating it and, at the same time, forces it against the surrounding earth.

The Standardization of Horizontal Tubular Boilers

THE question of arriving at a satisfactory method of standardizing the specifications for horizontal tubular boilers has been under consideration by manufacturers in Canada and the United States for some considerable time past. The aim is to arrive at a uniform specification for boiler inspection in order that boilers manufactured in one province or state may be sent to any part of the country and put into operation without subsequent inspection and the attendant risk of incurring a penalty in pressure, so frequently imposed as a safeguard. The problem was discussed in all its aspects before a conference of manufacturers and inspectors which was held at Pittsburg, Pa., in October last and various recommendations were made, of which the following are the more important:

1.—Factor of safety of five.
2.—Fusible plugs in all boilers.
3.—All rivet holes to be reamed. Plates up to and including 5/16 of an inch to be reamed 1/8 of an inch, from 5/16 to 5/8 inclusive, 1/4 of an inch, above 5/8 in. drilled from the solid.
4.—Tube holes to be cut from the solid or punched ½ inch smaller and reamed to size.
5.—The pitch of diagonal braces to be the pitch of stay bolts, plus 2 inches to be the allowable pitch for diagonal braces in the boiler. Pitch to be taken from centre to centre of rivets.
6.—Through rods to be pitched the same as diagonal braces.

The recommendation was also made that horizontal seams of shells be butt strapped in all cases except boilers 36 inches in diameter not exceeding 100 lbs. working pressure, boilers 40 ins. in diameter to have a manhole above the tubes. Boilers above 48 ins. in diameter to have two manholes, one above and one below the tubes, all boilers not having a manhole to have a handhole in the front head.

The desirability of uniformity in the interests both of the consumer and the manufacturer was shown in a paper read before the American Boiler Manufacturers' Association, at Cleveland, Ohio, in September last by Mr. Thos. B. Durban, General Manager of the Erie City Ironworks. Mr. Durban pointed out that the large number of inspection laws had made it almost imperative that the man engaged in the manufacture of boilers for distribution throughout the United States should do his utmost to have the laws so constructed that he did not have to carry a stock of material and stock of boilers on hand to meet the requirements of the various laws in the several states and cities. There was no firm manufacturing boilers that did not suffer from a lack of uniformity in state or city laws. Of all those engaged in making the various types of boilers for distribution throughout the United States and Canada, he ventured the assertion that there were few that had not met with considerable loss. He thought that a concurrent effort among the manufacturers of boilers and mechanical engines, also users of boilers, could not help but bring approximately concurrent legislation. He estimated that there were at least one hundred laws and changes to laws in the United States which alone governed the manufacture of boilers. These could be multiplied by one thousand times as many inspectors as there are laws. The present laws, as enacted, had been of great benefit, having reduced what was frequently guesswork, to something definite and right. These laws were classified as follows:

1.—Group comprising Massachusetts, Ohio, Detroit, Manilla, Chicago, and Indiana. Detroit, Ohio and Manilla laws are practically identical. Massachusetts law differs somewhat and the Chicago and Indiana laws are modifications.
2.—The group comprising all British specifications in which they were interested—British Columbia, Alberta, Saskatchewan and Ontario, all of which were copies or modifications of the British Columbia law.
3.—The group comprising inspection laws—Philadelphia, Seattle, St. Louis, Los Angeles, Montana and others. The laws of this group differed from each other, but in a general way were less complicated than those of the other groups.

All the laws in the United States united on the factor of safety of five, the Canadian laws requiring the factor of safety of five and one-half to six and one-half, but it was optional with the inspector what factor of safety he would accept, depending upon his opinion of the good workmanship that was done and upon how the boiler happened to strike his fancy. The butt-strapped seam was in demand on all boilers, due to the fact that it had been proved to the satisfaction of many people that lapped seams were a menace to the life of the boiler, and many boiler explosions had been attributed by experts to the lack of seams in the longitudinal section. Mr. Durban made a number of recommendations in regard to specifications. The more important of these were that boilers be built on the factor of safety of five, of uniform steel and that the specification over ange steel; that all seams be butt strapped with inside and outside covering straps, that all manholes be 11 by 15 ins.; that no plates be used in the tubular boiler thicker than ⅝ ins.

Inspection Laws in Canada

A conference on Uniform Regulations for the Inspection of Boilers in Canada was held at the Parliament Buildings, Toronto, recently. Representatives of boiler manufacturers from all over Canada, with the exception of Alberta and Prince Edward Island, attended, and the Deputy Minister of Public Works for the Province of Ontario, Mr. R. P. Fairbairn, presided on the opening day. The attendance also included Mr. D. M. Medcalf, Inspector of Boilers, Toronto.

The conference was concerned mainly with a revision of the Ontario regulations for the construction and inspection of boilers.

Section 17 (Sub-Section G) was revised to read thus: "All bridges used for manhole and handhole doors must be wrought iron, cast steel or of pressed steel design, and of ample strength to withstand the stress put upon them. Bridges used for doors not exceeding 3½ by 5 ins. may be cast iron."

Regarding the maximum pitches for rivetted joints, a suggestion was made that the British Board of Trade rules for rivetted joints should be adopted, and Section 30 was amended by the addition of the following footnote: "When the thickness of butt straps is not less than 1-16 ins. in excess of thickness required by Section 41, the value of T in the formula may be increased 1-16 of an inch."

Section 40, governing the distance between rows of rivets, was adopted in its entirety, subject to a few minor alterations.

Section 41 of the Saskatchewan regulations was also adopted instead of Sections 41 and 42 in the Ontario regulations dealing with the butt straps and the full number of rivets in all rows.

Section 43, dealing with longitudinal seams, was replaced by the following Section: "All longitudinal seams on horizontal return tubular boilers must be above the highest water line of the boiler. No longitudinal lap seam of any boiler shall have a continuous line of more than 10 ft., and when the boiler is made of more than one course of plate the longitudinal seams on adjoining courses in all boilers shall not be less than 45 degrees apart, and all plates and boiler shells must be so bent that the longitudinal seam is at right angles to the direction of the fibre of the plate. Butt straps must be cut from plates and not from bars and must be of as good quality as the shell plates."

Inter-Provincial Inspection

Towards the close of the conference a long discussion ensued with regard to the inspection of boilers. It ended in the following resolution being passed on the motion of a British Columbia representative, seconded by a representative from Saskatchewan:

"That while it is very desirable that every effort should be made to establish a satisfactory system of inter-provincial inspection as soon as possible, this conference recognizes that all the provinces are not sufficiently organized, and regrets that until arrangements are made for equalizing the standard of provincial examinations so that the qualifications of inspectors may be similar for all provinces, a complete system of inter-provincial inspection cannot be generally adopted. The conference would strongly recommend that this matter be taken up at once by the individual provinces with any other province where the inspection service is organized, and with the other provinces, as rapidly as they complete their organization, along lines that are satisfactory to the provinces for which boilers are being constructed."

The Construction of Creosoted Wood Block Pavements

By R. S. Manley

A CREOSOTED wood block pavement should show no evidences of wear for many years if the proper materials are used and if they are assembled in the proper way.

The correct depth of base, or foundation, varies with the soil conditions, but the materials forming this concrete foundation and the methods of mixing are in such common use as to be standard and easily secured.

We are interested principally in the construction placed on top of the concrete. The principal causes of defects of more or less serious nature are: (1) irregular or uneven surface, due (a) to careless laying (b) to shifting of sand cushion, (c) breaking or settling of concrete; (2) expansion difficulties due to the entrance of water into the blocks either by way of the joints or from below.

The first (irregular or uneven surface) is death to any paving material because a depression in the surface holds water and repeated churnings of wagon wheels in the depression are bound to cause an enlargement and deepening of the depression.

To avoid "a" the concrete should be mixed quite wet and finished smoothly with a flat wooden spreader, which gives a surface practically as even and uniform as could be obtained by templet. On this should be spread from ½ in. to 1 in. of clean sand, making the sand cushion conform to the contour of the finished street. On this place the blocks quite closely together, roll thoroughly until a perfect surface with no inequalities has been obtained and until the blocks are firmly in place. It will require a great deal of rolling to accomplish this, but the end justifies the means. After this fill all joints two-thirds full of hot bituminous filler of such melting point as is suited to climatic conditions, and spread a thin coating of sand thereon. The use of the bituminous filler is, in my estimation, the most important of all. It converts the street into an effective watershed which, without absorbing any of the water, directs it into storm sewers or other drainage paths. Should any water remain on the surface the wind and the sun, both good evaporative agencies, will rapidly dissipate it.

Now, you have an absolutely even surface waterproofed and converted into a watershed. This surface can not be worn by traffic, because the pressure of wheels is even and regular and there is no dropping or jolting of wheels entering and leaving low spots. The blocks are laid tightly together, so that there is no wearing at the joints. There can be no change in the sand cushion as long as the surface remains intact. It is, in fact, a solid covering of wood blocks cemented together by the filler, and consequently the difficulty of shifting cushion is avoided. It is assumed that the concrete is sufficiently strong so that it will not break or settle. In planning the depth, any error should be on the side of too great, rather than too little depth.

Expansion difficulties are eliminated by the use of bituminous filler, for there can be no expansion without absorption of water, and no absorption of water when all rainfall is conducted quickly to drainage sewers. In addition to this it must be remembered that with the bituminous filler each block is surrounded by an individual expansion joint.

The other way of constructing wood block surface, which is sometimes recommended, is to provide a mixed sand and cement cushion and sand filled joints or interstices. The sand and cement cushion does not give the opportunity for absolutely smooth surface that the sand cushion gives and is considerably more costly. The sand filler in the joints allows moisture to be absorbed in the pavement, and ultimately this moisture gets into the blocks and trouble ensues. It is only on extremely heavy traffic streets that sand can be used as a filler without expecting some expansion difficulties sooner or later. The proof of the pudding is the eating, and the proof of theories of wood block construction lies in the actual occurrences on the street.

It can be stated without fear of successful contradiction that every sand-filled pavement in the South has at one time or other given trouble from uncompensated expansion; and with equal confidence it can be stated that not one bituminous-filled pavement has given trouble from this cause.

Now, there have been objections put forward to the bituminous filler because of the belief that it would produce a sticky surface, disagreeable in warm weather; but if the proper filler is secured, and it is correctly applied there can be no such objection. The suitable filler has a consistency of rubber and can be taken in the fingers, bent and twisted without soiling the the fingers. In applying this filler a spreader with squegee attachment places the filler in the joints where it is needed and not on the surface of the blocks where it is not needed.

It is proper also to use less creosote oil per cubic foot of timber when bituminous filler is used, for the primary function of the creosote oil in this case is to preserve against decay instead of trying to make the creosote oil fill the double role of preservative and absolute waterproofer. No one familiar with preservative methods and history will question the efficacy of 16 lbs. of creosote oil per cu. ft. in preserving against decay for an indefinite period. We, therefore, see that bituminous filler can be used carefully and without inconvenience because of stickiness.

To sum up, therefore, provide adequate smooth concrete foundation, use enough sand to cover any inequalities in the concrete or depth of blocks (except in railway areas and on grades when use sand and cement mixed), lay blocks tightly, roll until smooth, fill joints with bituminous filler, spread coating of sand, and turn on traffic.

Constructional Details in Relation to Lighting Efficiency[*]

IN making the fullest use of day-light there are several factors to be borne in mind. For one, the window area above a certain level must be as large as possible. Fortunately now, through the development of reinforced concrete construction, with its possibilities of slender columns and shallow lintels, and of metal window sash, making possible very large windows with many small panes, yet without appreciably obstructing the light, it is possible to have more than 90 per cent. of the wall space glass. Metal sash, when properly fitted into the concrete, are practically dust and air tight and in this respect possess an important advantage over the old style wooden windows. One manager found that by using these he saved enough on his fuel bill the first winter to warrant the additional investment involved. He was influenced to adopt metal sash chiefly because of their superior fire-resisting qualities. But he found that they had many other advantages not the least of which was that they admitted fully 25 per cent. more daylight.

Window Area and Heating Problems

Large window area was formerly held objectionable on account of the supposedly greater difficulty of heating. With wood frames this objection is doubtless potent. This is because wood cannot be made airtight. It is the heat loss around the frame rather than through this type of window than through a 12-in. properly fitted, are practically leak-proof. In fact, tests have shown that no more heat is transmitted through this type of window tha nthrough a 12-in. brick wall. Double-glazing of the sashes decreases this loss still further, and the maximum result is obtained by duplicating the sashes as well. This is expensive, yet probably preferable to sacrificing any appreciable portion of the wall space available for windows in order to effect a slight saving in heating cost. In fact, accurate analysis in many instances no doubt would show that, from the standpoint of heating economy, double windowing pays. At all events, with metal framing available, there is no valid reason for not taking the fullest advantage of wall area for lighting.

Position of Windows and Lighting Efficiency

Window area close to the floor is almost valueless for lighting. At a height of about 3 feet the light rays begin to be effective as an aid to work and from this point upwards their value increases with each inch. Windows, therefore, should extend very nearly if not quite to the ceiling level, and there is no good structural reason why they should not. If the designers appreciate sufficiently the importance of the upper part of windows for lighting, they can very easily arrange the lintels so that the window frames fit snugly up to the ceiling. The maximum possibilities in this respect are afforded by reinforced concrete construction and in this material by the flat slab, or beam-and-girderless type. In this type of floor, the windows can be extended quite up to the face of the slab, the maximum admission of daylight secured, with no projections on the ceiling to obstruct the light after it has entered. The flat ceilings have a decided advantage, too, when it comes to artificial lighting, particularly if the indirect or the semi-indirect system of lighting is used. The unobstructed flat expanse, when white-coated, furnishes an ideal reflecting surface. Moreover, it permits the placing of fixtures to the best possible advantage, with no limitations on account of beams and girders.

Conserving Daylight

Next in importance to securing the maximum entrance of daylight is the conservation of the daylight after it has entered. Like anything involuntarily trapped, light unceasingly hunts for opportunities to escape. Dark or dirty walls and ceilings furnish such opportunities. The amount of light that will be absorbed in this way is surprising. To offset this loss, therefore, the interior surfaces and all objects within, so far as practicable, should be dressed in white and kept scrupulously clean. One manager found that by adopting such a policy he was able to do without any artificial light for over a month longer than formerly, and when at last the shortening days compelled him to light up, he found that he could get along without the lights, on the average, nearly an hour longer each day than under the old conditions. The saving he made in his lighting bill paid several times over for the expense of white-coating and systematic cleaning.

Much depends upon the kind of white-coating used. When a few years ago the value of white-coating factory interiors began forcibly to be recognized, common whitewash or calcimine was much used, particularly for painting concrete and brick. This has the merit of being cheap and easy to apply; also it is an excellent fire-retardant, which makes it popular for painting wood partitions; but it is not a durable coating. Besides, it collects dirt and dust rather easily and displays an annoying tendency to flake off.

To meet the demand for a better kind of white-coating, cold water and enamel paints containing neither oil nor a varnish have been developed. These are more costly than whitewash, but are so much more durable, as a rule, that they are really more economical.

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[*] Concrete-Cement Age.

When once an interior has been carefully coated with a good pure white, glossy paint, and care is exercised in keeping it clean, renewal is unnecessary for several years. The cheeriness imparted by such an interior is not the least consideration. It makes everyone feel better towards his fellows and his work, and as a result production is speeded up. So the gain is manifold.

Columns and walls, within the reach of fingers, are usually painted a dark color, so that finger marks will not show. A little light is lost in this way, but the gain in cleanly appearance more than compensates.

It is also important to guard against premature light absorption. If on any side an adjacent building is so close that it cuts off a portion of the direct rays, that building should be painted white. The same holds true of light courts. It is really surprising what a difference it makes to paint a nearby outside wall white. In many cases so doing has rendered artificial lights, towards the end even of the long winter days, unnecessary or necessary for a shortened period of time.

In cases, even with the nearby parallel walls white-coated, the height of these is such, or the space between so narrow, that some further expedient is necessary if the daylight that falls between a pair of buildings is to be manacled and led within. Such an expedient has been developed in canopies or awnings of prism-glass. These intercept the vertical rays of light and divert them horizontally inward. By this means has been lighted many a factory basement which otherwise would have required artificial illumination, by day as well as by night.

Similarly, by glazing the windows with prisms, buildings of low storey height or extra wide extent as compared to the ceiling height have been satisfactorily daylighted.

The Use of Ribbed Glass

Ribbed glass to some extent accomplishes the same purpose, and because considerably less expensive it is much more commonly employed. In fact, its use is favored as a means of diffusing the direct sun rays, regardless of whether or not the horizontal inward-reflecting of the rays is necessary or helpful. Moreover, it accomplishes the purpose of obscuring the view.

At least one factory manager found, however, that the glazing of the lower as well as the upper sash with ribbed glass was inadvisable because the shut-in, prison-like appearance thereby given the factory has a depressing effect on the operatives, further that it increased the difficulty of attracting and holding high-grade men. He stumbled on this objection one day as he heard a workman, who was leaving, give his reason to a fellow-workman: "I am going somewhere where they don't keep you cooped up as if you were in a prison." So forthwith he had the lower sashes glazed with clear glass. After that fewer men seemed to quit without valid reason; and although he figured that some time was lost through the men looking out of the windows, he decided that he was still the gainer by having fewer changes in his force and more contentment.

Width is a limitation only in multi-storey buildings. In one-storey structures the requirements for natural lighting impose no limitations, for dependence no longer needs to be placed on side windows solely. The roof may be skylighted in such a fashion as to make the interior altogether independent of the windows. Lighting by means of skylights is not altogether satisfactory, since the direct rays of the sun, snow in winter time, and condensation combine to make many troubles, aside from interference with the passage of light. Much depends on the slope of the roof. The troubles are a maximum with flat-sloped roofs. With direct sun rays the problem may be overcome by the use of ribbed glass, which diffuses the light; and if this is not enough in summer, by whitewashing or curtaining with white muslin on the sunny side, thus keeping out the heat but not especially impairing the illumination. The difficulty due to condensation may be greatly lessened by limiting the roof slope to 1:3 and extending gutters along the lower edge underneath the skylights; also by running a few heating pipes close to the under side of the lights. The trouble with snow can only be overcome by having the slope steep enough so that it cannot collect on the roof, or by a suitable system of maintenance.

Sawtooth Roof Construction

By far the best way, however, to overcome objections to skylights is to adopt the sawtooth type of roof construction. With this, perfect interior natural lighting may be secured. By facing the sawtooth towards the north the problem of direct sunlight is obviated. The slope of the tooth does away with any snow nuisance and largely with condensation and what small nuisance is occasioned on this score is circumvented by running gutters underneath the notch of the sawtooth and by extending heating pipes in each tooth. Sawtooth construction increases slightly the difficulty of heating a factory; also it is higher in first cost. But when everything is taken into consideration, particularly the fact that this is the only kind of skylight with which it is possible perfectly to daylight interiors, the greater initial cost easily is justified.

Glazed Roof Tile

If, for some good reason, sawtooth construction is not favored, then the maximum results with flat-skylighting is furnished by adopting cement tile for roofing. With these it is possible, by casting plates of glass in the tiles, to have 50 per cent. or more of the roof surface transparent. A very economical skylighted roof is thus secured.

In cases in which the width of the building is not so great as to require sawteeth, very effective natural illumination is secured by making that part of the roof nearest the eaves practically of solid glass—in effect extending the windows upward around the angle formed by the juncture of wall and roof. The width of the strip of roofing to be made transparent is approximately determined by drawing a 45-deg. line from a point within the floor level, at or just beyond the median line of the building, up through the roof. Where this line cuts the plane of the roof determines the innermost margin of the skylights. When so located skylights are much more effective than the conventionel ridge type—unless, of course, the roof is nearly flat or inclined inwardly.

Cleanliness Essential

Keeping the windows and skylights clean is the next important essential to making the most of the illumination nature affords. Neglect to clean the transparencies with sufficient regularity greatly diminishes their effectiveness. Tests made in one instance, in a factory where the windows had not been cleaned thoroughly for months, showed that after a good cleaning fully fifty per cent. more light was admitted. And it is quite possible for 75 per cent. and even a greater percentage to be thus lost. Every speck of dust, however minute, constitutes a light leak. Usually neglect of this kind is due not to parsimony but to lack of a suitable system of maintenance. If to parsimony, nothing could be more foolish, since for every penny saved on cleaning labor at least a dollar leaks out in the artificial light bill, to say nothing of the lessened efficiency of the operatives, due not only to lack of sufficient daylight but to the dispiriting effect of the uncleanly and gloomy condition.

In making the most of daylight there is still another expedient that may be invoked. This is to start to work a half hour or an hour earlier during the period when the days are shortest and artificial lights required the longest. Most would be gained by so doing at the extreme eastern margins of the Standard Time zones; least, at the extreme western. The fact that custom and tradition must be encountered is the only drawback; but concerted action on the part of the manufacturers in one locality should easily be able to overcome these. Within late years there has been considerable agitation both in agricultural and industrial circles for a more logical adjustment of the hours of work with the period of daylight, and it would seem to be worth while on the grounds of economy, for manufacturers everywhere to put themselves solidly back of this change and make it go. One manager, a few years ago, in rebuilding, moved his plant from the eastern part of Massachusetts to Niagara Falls—from the eastern edge of the eastern standard time zone to the western edge—purposely to have the advantage of later dusk, and he found he gained nearly 40 minutes in this way. He could, of course, have affected the same result by starting to work earlier in the old location, but he did not care to combat precedent to that extent. At all events, when contemplating a change in location, it would seem well worth while for the manufacturer to consider this point.

Terra-Cotta in Building Construction

By H. L. Fitzsimmons, Prince Albert, Sask.

IN Europe there are numerous examples of architectural terra cotta which have been exposed to weather for three or four centuries and which are still in good condition, while examples of stonework, subjected to the same conditions, are more or less worn and decayed. There is at the Louvre, in Paris, at the present time, some glazed terra cotta, said to have been made by the Assyrians in the sixth century, before the birth of Christ. In other museums there are some vases and other ancient terra cottas from Egypt and Greece, as well as some famous examples of work made in the Middle Ages, some of which are as perfect as if recently made. All these ancient terra cottas tell the story of durability and proclaim terra cotta to be a material worthy of the genius of those artists of antiquity who wrought so beautifully in this medium.

The Surface of Terra Cotta

The body of all good terra cotta is very much the same, but there are several ways of treating the surface, resulting in products which may be classified as follows: Standard terra cotta, vitreous surface terra cotta, mat-glazed terra cotta, full-glazed terra cotta and polychrome terra cotta. Standard terra cotta has no surface given it, which affects its porosity, a drop of water placed upon it being soon absorbed; it will absorb, also, a great amount of dirt from the atmosphere, and will become very much darker from continual exposure. On some buildings this weathering down is not objectionable; in fact it sometimes lends a charm, producing an antique appearance, which is often very desirable from an artistic point of view. Some one has said that "time is the greatest artist," and, therefore, when it is desired to produce an aged effect, standard terra cotta should be used. It is, consequently, a good material to use for rustic work in connection with country houses, college buildings, gateways, and certain styles of churches. This class of material is made in any color desired.

Vitreous surface terra cotta has a very thin spray of the surface which vitrifies in the burning process, forming a thin glaze which sheds water. This terra cotta will not absorb much dirt from the atmosphere, as the rain of each storm washes it off. It therefore practically retains its original color. This class of material is made in any color desired and is used more than any other kind at the present time, as it seems to satisfy the greatest number of requirements.

In western cities where soft coal is used, and where, consequently, most buildings are cleaned frequently, any material of a non-porous nature is very desirable, and it has been found that glazed terra cotta ranks with the most superior materials in this respect. On this account white glazed terra cotta is used to a great extent in these cities. The lustre of the glaze is deadened for artistic reasons, the glare of the sunlight on full glazed terra cotta being very severe. This is now done in the process of burning, as it has been found that sand blasting the material neutralizes the purpose of the glaze. This method has, therefore, long been abandoned by the leading manufacturers. There are many examples of buildings constructed of this material in the west and the most notable example in the east in the Plaza Hotel, New York.

For light courts, loggias to office buildings, theatres, interiors of railway stations, train sheds and power houses the full glazed terra cotta is preferable, as it helps illumination and gives a more brilliant effect.

The full glazed terra cotta and mat-glazed terra cotta are made in any color required, and when various colors are used on the same buildings, the material is termed polychrome. The various colors may be applied to the same piece if desired, or each separate color may be kept on a separate piece, if the design will permit.

Color of Terra Cotta

Within the past twenty years a great impetus has been given to the production of special colors in architectural clay products. In 1885 fully four-fifths of the terra cotta produced in the United States was red. Now there is less of red used than of almost any other color. Buffs and greys of several shades, white and cream—white are now the prevailing colors. By the use of ceramic colors almost any required tone may be produced, and the effect obtained by using glazed terra cotta of various colors in combination, such as blue, yellow, white, purple, brown, old gold, green or red is often very beautiful. If any particular shade of color not included in the manufacturer's standard samples is desired, the architect should consult with the manufacturer, who will then experiment until the required color is not only produced, but guaranteed to be permanent and free from all tendency to crack. It is generally agreed that there is a great field for this polychrome terra cotta, especially for theatres, restaurants, and buildings of a similar nature, for interiors, loggias, fountains and department stores.

Although the art of using colored terra cotta is very ancient, having been in practice before the Christian era, it is, to some extent, an undeveloped field in this country and offers alluring possibilities in architectural design and construction. It can be used in a very modest and sparing way as well as very profusely; and either in soft tints or in brilliant colors, as the taste of the architect may dictate. Where a rich decorative treatment is required, as in the interiors of public buildings, like our great stations, hotels and theatres, polychrome terra cotta can be employed most effectively and economically. In variety and beauty of tones, terra cotta has now reached a very high standard of excellence, and may be used by the architect to express the highest type of his art. The almost unlimited possibilities presented by the judicious application of colored glazes for exteriors as well as for interiors, has awakened an unusual interest in the use of polychrome terra cotta, a building material with superior qualities of resistance against the deteriorating effects of time and of the action of fire and frost.

Terra cotta is not imitation stone and should not be used as such. It is a material having peculiar qualities which give a distinctive character, and therefore, to be successfully used, it should not be employed in such a way that it will appear as an imitation of, or as cheap substitute for some more expensive material. This may be brought about in several ways. There may be used certain forms and certain styles or ornament more characteristic of terra cotta than of any other material.

One architect has evolved a certain style that he has applied to many buildings, and which is not suitable to any material other than terra cotta. This may be said of both the form and ornamentation of his buildings. The architects of the Flatiron building and of the Wanamaker building, in New York, have successfully used this material for its own sake and not as an imitation. Another firm of architects have used profusely modelled terra cotta to produce highly ornamental effects not so easily obtainable in other materials, and their recent use of colored terra cotta is typical of this material alone. In the West Street building, New York, the architect has made a design distinctly expressive of the material used. This is noticeable in the ornamentation, in the form of cornices and molding, in the coloring and even in the plain shaft of the building. In the Brooklyn Academy of Music the architects have accomplished this result by the use of color.

In regard to the use of terra cotta, it has been said that it is by the use of polychrome terra cotta that the material has its best opportunity for expressing its individual character. It was so in antiquity, in the Middle Ages, and is so at the present time, because polychrome terra cotta is a material complete in itself, and used for its own sake. It cannot by any means be considered an imitation of, nor a substitute for, something better.

Durability of Terra Cotta

The principal value of terra cotta lies in its durability. When made of the right materials and properly burned it is impervious to water, or nearly so. When glazed it is absolutely impervious, and hence not subject to the disintegrating action of frost, which is a powerful agent in the destruction of stone. It does not "vegetate," as is the case with many stones. The ordinary acid gases contained in the atmosphere of cities have no effect upon it, and the dust which gathers on the moldings is washed away by every rainfall. Underburned terra cotta does not possess these qualities to so high a degree, as it is more or less absorbent. Another great advantage possessed by terra cotta is its resistance to heat, which makes it a most desirable material for the trimmings and ornamental work in the walls of fireproof buildings. Although terra cotta has been used in this country for but a comparatively short time, it has thus far proved very satisfactory, and the characteristics above indicated would point to its ranking, in common with the better qualities of bricks, with the most desirable of building materials.

Inspection and Methods of Setting

A sharp metallic, bell-like ring and a clean, close fracture are good proofs of compactness and strength. Perfection of form is in the highest degree essential, and can result only from a homogeneous material and a thorough and experienced knowledge of firing. No spalled, chipped or warped pieces of terra cotta should be accepted, and the pieces should be so hard that they will resist the scratching with the point of a knife. The blocks should be of uniform color also, and all mouldings should come together perfectly at the joints. Terra cotta with a vitreous surface and mat glazed terra cotta should be so non-absorbent that water will lie in drops on its surface without being quickly absorbed. Full glazed terra cotta should be so non-absorbent that ink will not penetrate the surface, and may be entirely washed away with water.

Terra cotta should always be set in either natural cement or Portland cement, mixed with sand, and in about the same way as stone is set. As soon as set, the outside of the joints should be raked out to a depth of three-quarters of an inch to allow for pointing and to prevent chipping. The terra cotta should be built up in advance of the backing, one course at a time, and all voids, except those projecting beyond the face of the wall, should be filled with grout or mortar, into which bricks should be forced to make the work as solid as possible. All blocks not solidly built into the walls should be anchored with galvanized iron clamps, the same as for stonework, and, as a rule, all projecting members over 6 inches in height should be anchored in this way. After the walls are up the joints should be pointed with Portland cement colored with a mineral pigment to correspond with the color of the terra cotta. The pointing is done in the same way as in stone work, except that the horizontal joints in all sills and washes of belt courses and cornices, unless covered with a roll, should be raked out about two inches deep, calked with oakum for about one inch and then filled with an elastic cement.

Disadvantages and Cost of Terra Cotta

One of the principal objections to the use of terra cotta is the time required to obtain it, especially when the building is some distance from the factory. About six weeks are required for the production of terra cotta of the ordinary kind, and the architect should see that all the drawings from the terra cotta work are completed and delivered to the maker at as early a stage in the work as possible, so that he may have ample time to produce it. This will obviate any delay if the architect's drawing and instructions are clear, distinct and complete, as it takes longer to obtain the steel construction work than it does to make the terra cotta. Most of the delay in obtaining terra cotta is really due to the fact that prompt and careful attention is not always given to the preparation of the terra cotta drawings and instructions. Small pieces of terra cotta may sometimes be obtained within two weeks from the receipt of the order, when the molds are already on hand. It is always more expensive, however, to attempt to turn out work in such short order, and inexpedient on account of the risks in forcing the drying.

Terra cotta is generally less expensive than stone, and ornamental work costs in stone about three times as much as it does in terra cotta. Being lighter in weight, the freight charges are less. In large buildings the use of terra cotta reduces the cost of the steel construction, because when it is used on the exterior the steel may be about one-third smaller and lighter, thereby reducing the cost proportionately. This saving is an important item in large structures. The cost of erecting terra cotta is less than that of erecting stone, two storeys of an all terra cotta exterior being sometimes put in place in the same time that it takes to set one storey of stone. The advantage in point of cost in favor of terra cotta is greatly increased if there is a large proportion of molded work, and especially if the moldings are enriched. The use of terra cotta for trimmings, and especially for heavy cornices, in place of stone, often reduces the cost of the walls and foundations, as the weight of the terra cotta will be much less than that of stone, and the walls and foundations may be made lighter in consequence.

Weight and Strength and Tests

The weight of terra cotta in solid blocks averages 122 pounds per cubic foot. When made in hollow blocks 1½ inches thick, the weight varies from 65 to 85 pounds per cubic foot, the smaller pieces weighing the most. For pieces 12 by 18 inches or larger on the face, 70 pounds per cubic foot should be a fair average. The crushing strength of terra cotta blocks in 2-inch cubes varies from 5,000 to 7,000 pounds per square inch. Hollow blocks of terra cotta, one foot high, unfilled, have sustained 186 tons per square foot. From these and other tests I would place the safe working strength of terra cotta blocks in the wall at 5 tons per square foot when unfilled, and at 10 tons per square foot when filled solid with brickwork or concrete. If it is desired to test the strength of special pieces, two or three small pieces should be broken from the blocks and ground to 1-inch cubes, and then tested in a machine. Should the average results fall much below 6,000 pounds the material should be rejected.

Scientific means of accident prevention will be illustrated at the Panama-Pacific International Exposition by an extensive display in the Palace of Machinery of every device ever invited to protect workingmen. Negotiations have been entered into by the Department of Machinery of the exposition with William H. Doolittle, Safety Inspector of the National Trades Association, and the exhibit will be prepared under his direction.

Hydraulic Fill Levees on the Mississippi

THE use of steel slope boards, each about 10 feet long by 18 inches wide and made of No. 14 gauge steel with angle iron top, has made the construction of Mississippi levees by the hydraulic fill system entirely practicable, and in the Trempeleau District about 500,000 cubic yards of work is being done in this way. The boards are placed at the intersection of the side slope with the natural slope of the fill under construction. Several men equipped with shovels distribute the material evenly between the boards, and then move them ahead as the work progresses. The advantage of the slope boards is that levees can be built with any desired width of base and any convenient slope, one layer being added to another until the desired height is reached. Formerly it was thought necessary to deposit a certain amount of solid material on either side of the base before running in the hydraulic fill. This is now entirely done away with. Two separate levees were constructed in the Trempeleau District. The average width of the levee crown is between 8 and 10 feet and the height 14 feet. The slope on the water side is 1 on 3 and on the land side 1 on 2, with banquette against the land side, which is a roadway. The site for the levee was not cleared of vegetation or stumps, it being believed that the hydraulic method of construction would so completely seal the voids around the stumps as to prevent decay. The cost of the two levees was $45,000 figured at the contract price of 8½ cents per cubic yard. Work was begun in May, 1912, and finished in October the same year. In District No. 2, Henderson County, Ill., part of the levees have been constructed in the same way; and in District No. 1 two sections of the levee are to be constructed with the suction dredge. These will have a length of 20,500 feet, crown of embankment 8 feet, with 1 on 3 slopes, both sides, contract price, 11¼ cents per cubic yard. The rest of the levee is to be constructed with a drag line excavator at a price of 12.1 cents. The hydraulic fill levees are built of sand and silt with the sand on top. In the last high water, when the water was within a foot of the top for two days, no seepage was noticeable. With hydraulic fill levees a wide foreshore can be left, and there are no borrow pits left to aid in future seepage and possible failure of the levee. Any side slope can be built. There is no shrinkage, and the levee can be built across an old bayou or marsh with as little trouble as on high ground. The cost of a suitable plant is about $20,000.

Bituminous Concrete

Concerning bituminous concrete the following conclusions by Mr. Linn White, civil engineer for the South Park Commissioners, Chicago, are interesting: (1) Bituminous concrete and bituminous macadam of equal thickness require the same amount of bitumen per square yard. (2) Considering the total thickness of wearing surface and base, and disregarding first cost of plant, the only difference in cost between bituminous concrete and bituminous macadam is the difference in labor, amounting to generally less than 10 cents per square yard. (3) Old macadam is a difficult and uncertain proposition to penetrate with poured bitumen on account of dirty stone, and generally requires a new top layer of stone to produce a successful bituminous macadam, but if of substantial thickness may be utilized as a base for bituminous concrete. (4) The mixing and laying of bituminous concrete may be carried on during damp and cool weather when it would not be practical to construct bituminous macadam. (5) Bituminous concrete is of even thickness and even composition and consequently wears more evenly than bituminous macadam, no matter how well made, and costs less for repair and maintenance. In all these respects the advantage of comparison is in favor of bituminous concrete, except in the one of first cost.

An Interesting Discussion

FROM Mr. Frederick Osborne Smith, F.R.I.B.A., F.R. San. I., we are in receipt of a communication in which he takes issue with our London, Eng., correspondent on several matters discussed under the heading "Engineering Topics in the Old Land," in our issue of July 1 last. Below we give Mr. Smith's letter and also the bone of contention—the article in question.

Ottawa, Ont., July 22, 1914.

Editor "Contract Record,"

The remarks by your London, Eng., correspondent, published in your issue of July 1, referring to fresh air inlets in my article in the Journal of the Royal Sanitary Institute, have no relation to "Drainage and Sanitary Fittings in Canada," neither does my article describe the system I should adopt in England. It does, however, refer to the desirability of abolishing the foul gulleys from our English system which both directly and indirectly cause the bad odors which are unjustly attributed to the fresh air inlet.

The subject to which your correspondent's remarks do apply, is a very vexed one in the Old Country and turns upon the retention or abolition of the sewer gas interceptor. Much of the evidence and the results of experiments placed before the Departmental Committee were not representative of the experience of every-day practice; and it is therefore natural that little or no attention is paid to the Report, as lamented by your correspondent.

Those among us with many years' practical experience in connection with house drainage (not sewerage) will continue to use well-designed and consequently efficient interception with the low level untrapped opening, suitably protected, notwithstanding the severe remarks of your correspondent. Instead of abolishing the interceptor I hope to assist in abolishing the gulleys at the feet of waste pipes which are invariably more filthy than a carefully selected intercepter. The most efficient intercepter that I have seen and which I used nearly twenty years ago, was not among the types experimented with; I fear it would have given too good results. The whole trouble with the intercepter is that in the past the local authorities compelled builders to insert larger traps and drains (with insufficient fall) than were necessary for the small quantity of sewage that was to pass through them, and consequently the pipes became encrusted with grease and sand which periodically breaks away in hard lumps and chokes the intercepter. I know of a case not far from Westminster where the engineer approved a 9-in. intercepter fixed with its outlet higher than its inlet, where a 6-in. trap was specified and amply large enough. Can you wonder that there should be a lack of confidence in the opinions of municipal engineers on matters relating to house drainage?

The various valves mentioned in connection with fresh air inlets are useless and when in good working order are often the cause of serious trouble in other parts of the system. They are also in direct opposition to the by-laws.

Yours faithfully,
Fred. Osborne Smith.

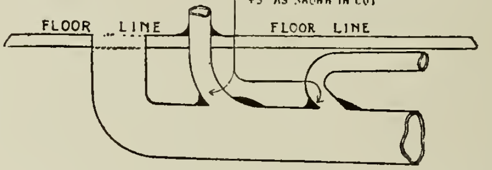
Drainage and Sanitary Fittings in Canada

By F. J. Osborne Smith

THE cold of the Canadian winter renders the adoption of the English methods of sanitation unworkable, and it is therefore not surprising that the Canadians should have adopted the system in use in the United States, where climatic conditions more closely resemble their own. The principal difference between the English and Canadian methods is the abolition of the gullies at the feet of waste pipes and all pipes being inside the building, so that a soil pipe may and often does receive sink and bath waste water and sometimes rain water. This latter depends upon the position of the outlet.

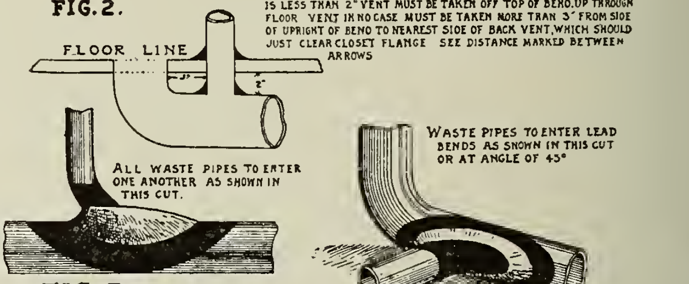
A moment's reflection will enable one to realize that pipes and gullies outside would soon be blocked with ice when the temperature remains below freezing point for weeks together, and frequently below zero.

FIG. 1



WHERE WASTE PIPES ENTER TOP OR SIDE OF HORIZONTAL LEAD BEND. LEAD SOIL OR LEAD WASTE PIPE, IT MUST ENTER SAME AT AN ANGLE OF NOT LESS THAN 45° AS SHOWN IN CUT

FIG. 2.

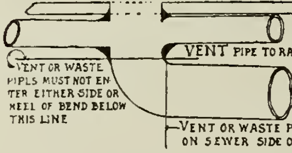


WHERE THE DISTANCE FROM TOP OF LEAD BEND TO UNDER SIDE OF FLOOR IS LESS THAN 2" VENT MUST BE TAKEN OFF TOP OF BEND. UP THROUGH FLOOR VENT IN NO CASE MUST BE TAKEN MORE THAN 3" FROM SIDE OF UPRIGHT OF BEND TO NEAREST SIDE OF BACK VENT, WHICH SHOULD JUST CLEAR CLOSET FLANGE SEE DISTANCE MARKED BETWEEN ARROWS

ALL WASTE PIPES TO ENTER ONE ANOTHER AS SHOWN IN THIS CUT.

WASTE PIPES TO ENTER LEAD BENDS AS SHOWN IN THIS CUT OR AT ANGLE OF 45°

FIG. 3.

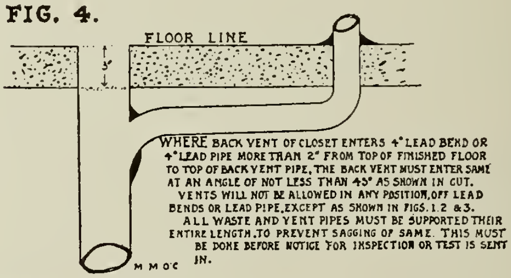


VENT PIPE TO HAVE FALL, ON HORIZONTAL RUN, OF 1/8" TO ONE FOOT, NOT MORE. AND MUST BE CUT SO AS TO JUST CLEAR UNDER SIDE OF FLOOR, WHERE IT TURNS TO RUN TO CLOSET BEND. AS SHOWN IN CUT.

VENT OR WASTE PIPES MUST NOT ENTER EITHER SIDE OR HEEL OF BEND BELOW THIS LINE

VENT OR WASTE PIPES MAY ENTER BEND ON SEWER SIDE OF THIS LINE

FIG. 4.



WHERE BACK VENT OF CLOSET ENTERS 4" LEAD BEND OR 4" LEAD PIPE MORE THAN 2" FROM TOP OF FINISHED FLOOR TO TOP OF BACK VENT PIPE, THE BACK VENT MUST ENTER SAME AT AN ANGLE OF NOT LESS THAN 45° AS SHOWN IN CUT.

VENTS WILL NOT BE ALLOWED IN ANY POSITION, OFF LEAD BENDS OR LEAD PIPE, EXCEPT AS SHOWN IN FIGS. 1. 2 & 3.

ALL WASTE AND VENT PIPES MUST BE SUPPORTED THEIR ENTIRE LENGTH, TO PREVENT SAGGING OF SAME. THIS MUST BE DONE BEFORE NOTICE FOR INSPECTION OR TEST IS SENT IN.

Where lead pipe is used for water or bent pipe it must be supported with boards when run on the horizontal, and with tags soldered to pipe when run vertically.

The omission of gullies which receive sink and bath water appeals to me very much, especially now that I have had actual experience of the system, and I am convinced that it is more healthy than the foul and evil smelling gullies in England. It behoves sanitarians to give this matter careful thought and attention with a view to removing these defects in the English system of house drainage.

The accompanying diagrams are supplied by the Local Board of Health, Ottawa, to licensed plumbers to explain the by-laws regulating plumbing. They will help to illustrate the following notes.

Eaves gutters with rain water pipes are seldom used, but other rain water pipes are trapped at their feet before they connect with the drain. Access to the trap for cleaning is provided by a 4-inch brass screw cap.

Drains inside the building and to three feet outside are usually made of iron pipes jointed with gaskin and blue lead, laid to a fall of 1 in 48. Junctions must not have a greater angle than 45 degrees. The following table gives the weights compared with London County Council weights:—

Diameter.	L.C.C. Soil pipe.	City of Ottawa.	P.W. Dept. Canada.	L.C.C. Drain pipe.	
6″	16	15	20	25½	lbs. per foot.
5″	11½	13	17	21	lbs. per foot.
4″	9	9	13	17¾	lbs. per foot.
3″	—	6½	9½	12	lbs. per foot.
2″	—	4	5½	—	lbs. per foot.

The usual length of each pipe is five feet, and it has the weight stamped on the outside. The pipes are coated to prevent them from rusting.

Intercepting traps are optional in Ottawa, and when used must be placed inside the house wall with a cleaning cap; provision must be made for ventilation (F.A.I.) and a cleaning junction beyond it with brass screw cap, and the trap must be an approved design.

Brick chambers are rarely necessary, as the trap and cleaning junctions are generally in the cellar.

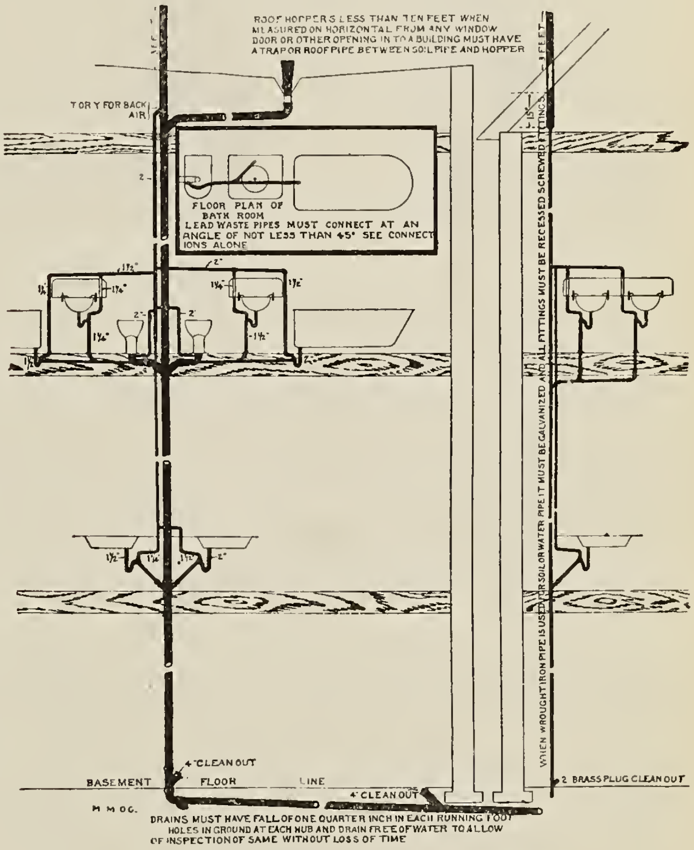
Fresh air inlet is 4 ins. diameter, and connected near the trap, and taken outside and fixed as far as possible from any opening into the house, terminating at least 18 ins. above ground, and left open or covered with a cap having an area of one-fourth more than that of the pipe. When left open they are usually fitted with a semi-circular bend, fixed vertically.

Soil pipes are fixed inside the building, and are iron pipes of similar weight to the drain pipes. They extend from the drain to the top floor ceiling, where they are enlarged one inch in diameter, and continued through roof to 3 feet above, and the end of the pipe bell-mouthed and fitted with a copper cap. The increase in diameter is to allow for the vapour condensing and freezing on the interior of the pipe, which would otherwise cause a reduced internal diameter. At the feet of the vertical pipes a rest bend is fixed, supported upon a stone slab, and immediately above the bend is a junction with brass screw cap for access and cleaning. Similar junctions are fixed on the horizontal runs also. Branch soil pipes are made with 4-inch junctions for connecting to each w.c., and 2-inch junctions for connecting to each waste from basins, sinks, baths, etc., and a 4-inch junction on each branch for cleaning, with a heavy brass ferrule leaded into socket, with brass screw cap having 1½-inch square nut 1 inch high.

Antisyphonage pipes are connected to soil pipes below the lowest fitting and carried up through roof, and treated as soil pipes with all necessary junctions for connecting vents from w.c.'s, baths, sinks, etc. Every fitting must be supplied with a trap and ventilating pipe to prevent gas from sewer, drain, or soil pipe escaping into the building, and the trap must be fixed as close as possible to the fitting. No fitting is allowed to drain through more than one trap, the intercepter only excepted; the vent is not to be less than one size smaller than the trap, and no vent less than 1¼ inches. The vent from three w.c.'s is usually 2 inches, but when more than three a 3-inch pipe is required. All vent pipes must continue to rise after leaving a trap, and must not be less than 4 inches where they pass through the roof. Wrought iron pipes with steam fittings may be used for vent pipes from traps, or sometimes lead is used, but the weight is light compared with that used in London. I understand that lead pipe is expensive in Canada.

Rain-water pipes, when carried inside a building, which is usual, are of the same iron pipe as used for soil pipes and drains; this is only to be expected when it is remembered that in some cases they are not trapped at their feet, but connect direct into the drain.

Water closets are almost entirely of the syphonic type, with one trap and concealed outlet, and many have the syphon-jet-discharge. A pail of water will start the discharge and leave the seal reduced but not broken (about 1-inch seal remains); this is an extreme case, but in ordinary use the after flush charges the trap to its full capacity. The flushing cistern for these closets seems to have a capacity of about five gallons, which is extravagant and wasteful. The concealed joint is hardly desirable, except for appearance. It seems to be a reliable one that is used here. A brass collar with an internal thread is wiped into the lead branch, and a brass fitting is securely cemented into the fireclay of the pedestal; upon this brass fitting an external thread is cut, and the joint is made by screwing the two together.


ROOF HOPPERS LESS THAN TEN FEET WHEN MEASURED ON HORIZONTAL FROM ANY WINDOW DOOR OR OTHER OPENING IN TO A BUILDING MUST HAVE A TRAP OR ROOF PIPE BETWEEN SOIL PIPE AND HOPPER
T OR Y FOR BACK AIR
FLOOR PLAN OF BATH ROOM
LEAD WASTE PIPES MUST CONNECT AT AN ANGLE OF NOT LESS THAN 45° SEE CONNECTIONS ALONE
WHEN WROUGHT IRON PIPE IS USED FOR SOIL OR WATER PIPE IT MUST BE GALVANIZED AND ALL FITTINGS MUST BE RECESSED SCREWED FITTINGS
3 FEET
15″
2″
1½″
1¼″
4″ CLEAN OUT
BASEMENT FLOOR LINE
4″ CLEAN OUT
2 BRASS PLUG CLEAN OUT
H. M. OC.
DRAINS MUST HAVE FALL OF ONE QUARTER INCH IN EACH RUNNING FOOT HOLES IN GROUND AT EACH HUB AND DRAIN FREE OF WATER TO ALLOW OF INSPECTION OF SAME WITHOUT LOSS OF TIME

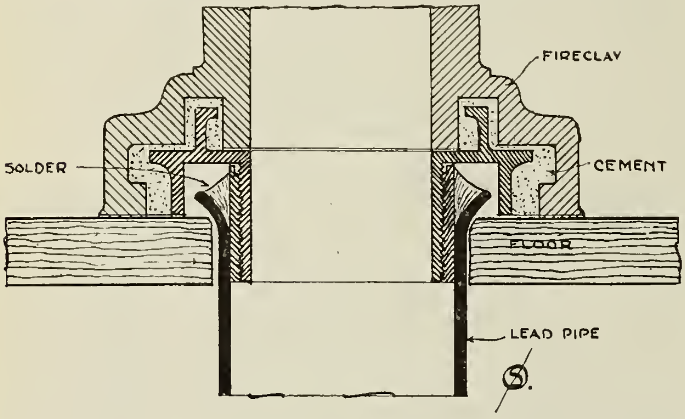
The iron drain shall extend through the wall.

Lavatory basins, baths and sinks are generally made of enamelled cast iron. The enamel is of very good finish. The brass work is all plated, also the grating in the kitchen sink, traps and waste pipes above the floor. The supply taps for baths are smaller than we use in London, and are joined together with one centre outlet, fitted to receive small rubber tube for hand shower, etc. As the supply of both hot and cold water to the fittings is often under the full pressure of the main supply, the small taps are not as inconvenient as they would be if a cistern intervened.

It seems very queer to see the cold water main connected direct to the top of the hot water cylinder, but it obviously must be carried down inside. There is no air pipe, nor is there a safety valve, as any pressure is supposed to relieve itself into the main, but in the event of the stopcock being closed I fear something would happen.

Urinals are generally the old-fashioned lip basin pattern, but the stalls in one piece of fireclay are beginning to be recognized as far superior.

In conclusion, I should like to mention a very interesting gully that is used in toilet rooms and cellars for floor drainage. It is a cast iron gully with a flushing rim, and a connection at the bottom of the trap through which a jet of water can be directed to remove the sediment at the same time that the sides are being washed by the water from the flushing rim.



Both hot and cold water are connected to these gullies with stopcocks to control the supply.

There are many interesting points in the system of house drainage in vogue here, and I feel sure that some of the arrangements might be adapted to our conditions at home, and in many instances would not only simplify, and thereby increase efficiency, but also reduce the cost, which is an important factor in any system.

The Design and Construction of Intercepting Sewers, with Special Reference to Minimizing Infiltration

ALTHOUGH many sewerage engineers consider extremely flat grades practicable for intercepting sewers, because of the depth of flow and the macerated condition of sewage on reaching intercepters, an occasional warning against too flat grades is sounded. Thus in a paper before the American Association for the Advancement of Science, Mr. J. N. Ambler, of Winston-Salem, N.C., urged the advisability of utilizing all the available fall. The following excerpts from the paper, relating chiefly to the minimizing of infiltration, are published by Engineering and Contracting:

All the sand, mud and illegitimate matter of all kinds which enter the collecting sewers is pushed down their shaper grades and is finally deposited in the intercepter.

The writer once removed some twelve or fifteen hundred bushels of such substances from about half a mile of old intercepter. Most of this was sand, but bottles, rags, straw hats, overalls, stones, wooden articles, etc., were present, and the capacity of the sewer was greatly reduced.

Of course, hard and fast rules cannot be laid down, but the writer does not approve laying a grade as flat as 1 ft. per 1,000. It is his endeavor, in the light of experience with cleaning, to get all the fall possible.

From the very nature of the low level intercepter, it is usually located where the ground is alluvial, and with the ground water level near the surface. In many cases the ground to be traversed is marshy, and in nearly every instance the sewer is laid below the ground water level. These conditions are distinctive for intercepters and require special methods of treatment.

Unless the joints are laid very perfectly and are so maintained at the flat grade as to utilize all the fall, without pockets, the infiltration of ground water will be so great as to greatly reduce the carrying capacity of the sewer, or even, in the case of a long line, to completely destroy its usefulness.

Settling of the joints will, of course, render the conditions worse, and may result in the inflow of quicksand until the sewer is put out of commission, as in a case which once came under the writer's charge for correction. It is, therefore, of the utmost importance not only to have perfect joints, reducing the inflow of the ground water to a minimum, but also to provide means to maintain the grade as a perfectly straight and rigid barrel, free from settlement.

The difficulties of meeting this last requirement are often very great, as usually the bottom of the trench is a water-soaked quagmire and frequently quicksand.

Considering, first, the question of perfection in the joints, the writer has specified a mortar or neat Portland cement, on account of its density and imperviousness. The shrinkage of neat cement mortar being considerable after the mortar is set, a wash of thick grout is used to fill the cracks. The entire circumference of each joint is rigidly inspected by hand, and no imperfect joint is left on the work.

Special compounds, as melted sulphur, and the various elastic compounds from which it is claimed that perfect joints may be made, even in water, were not tried, either on account of the expense, or because there was doubt felt as to the durability of such substances.

Feeling the necessity of having some criterion upon which to base the engineer's acceptance of the work, so far as ground water is concerned, the writer read up all available data on ground water flows, and came to the conclusion that it is a subject about which too little is known, and that many of the existing data are conflicting.

There should, however, be some criterion to apply to work done by contract, and it seemed that nothing better could be done than to determine how much water the sewer might be allowed to carry without materially injuring its usefulness. The criterion should not be so severe as to greatly affect contractors' bids. Such a criterion, it would seem, should be based upon the number and circumference of the joints.

The following clause appears in one of the writer's specifications, and is offered for what it is worth, until something better can be substituted. It at least has had the effect of securing some very careful work, and contractors were not disposed to regard it as severe when it was thoroughly explained to them.

The clause is as follows:

It is the intent of these specifications that no more leakage of ground water into the sewer be allowed than is admissible with a first-class piece of work, in which care has been exercised to get as near as possible to a water-tight result.

To determine the admissible amount of leakage, the length of a joint will be considered as the outside circumference of the spigot end of a pipe.

Leakage not in excess of 2 gals. per day of 24 hours for each foot of circumference of every joint will be considered admissible, the amount of flow to be determined by the engineer's gaging in each section, by means of a notch board.

The contractor agrees that for each 10,000 gals. per day of 24 hours by which the total flow of sewer exceeds what the total flow should be, when figured on the basis already given, a deduction of $100 from the contract price will be made.

This will not apply further than to a total flow resulting from 3 gals. per day of 24 hours, from each foot of joint length, beyond which figure the sewer will be regarded as not in compliance with this contract.

The writer's opinion is that the above requirement is a very mild one, as he once laid a mile of large sewer through exceedingly swampy land, passing under several streams, etc., with a result that not more than a stream ¼ in. deep was flowing in the bottom of the pipe at the lower end on completion. However mild the criterion may be, it has had a powerful effect against bad work.

It is extremely important that the manholes should not leak. To prevent this, the best hard bricks are used, each being dipped in a pail of water, as handed to the mason. The brick work rests on a cement bottom 12 ins. thick with a solid cement invert and the contact of the pipe with the masonry is an object of especial care. Manholes are built up sufficiently high above the meadow to prevent being stopped by floods. The caps are secured to the covers by two set screws to prevent malicious persons from placing foreign substances in the sewer.

The handling of water in the trench during construction is usually less serious than the inexperienced are apt to imagine. A diaphragm pump connected to a small gasoline engine is the cheapest and best way known to the writer for removing the water. A small trench is excavated along the side wall of the main trench which conducts all accumulated water to a pump, where it is promptly removed by pumps, without being allowed to rise on the freshly constructed sewer line.

The writer has used the pile and platform method of founding, and finds it of very general application, of moderate cost to handle, and very satisfactory in result. Two piles, 4 by 4 ins., bluntly sharpened, are driven opposite each other in the trench. Two more piles are driven at a distance of 2½ ft. up the trench, and so on, wherever a thoroughly firm bearing for the sewer cannot be found. Across the heads of these piles a 1 by 4-in. batten is spiked, and a platform of two 1½-in. planks is laid on and spiked to the various battens over each pair of piles.

Piles are driven to practical refusal by means of a rammer, consisting of a cast iron disc 8 ins. in diameter, 3 ins. thick, into the centre of which a 2-in. iron rod is screwed. This makes a very heavy rammer, resembling the piston rod and head of a steam engine. It takes three or four strong men to operate it, but it is the quickest and most economical way the writer has been able to find for this work.

The piles vary in length from 18 ins. to 9 ft. Even where the short ones are used, the ground being tolerably firm, a far superior foundation results than is to be had by laying loose planks in the bottom of the trench.

The platform was laid to a more or less regular grade about 0.3 ft. below the flow grade of the sewer, the pipe being supported in a cradle of two wedges cut from opposite sides until the flow line was precisely at grade.

The wedges were then spiked to the platform to hold them in position, and about ½ gal. of concrete was placed behind them to prevent a tendency for the back-fill to crush the pipe.

Sand and Coarse Material and Proportioning Concrete

By John A. Davenport, M. Sc. and S. W. Perrott, Professor of Civil Engineering at Liverpool University.

IN correctly made concrete the amount of sand should be just sufficient to fill the voids in the coarse material, and the amount of cement just sufficient to fill the voids in the mixture of sand and coarse material, and to coat all the particles with very thin jointing layer. It is a rational assumption that such concrete will give a maximum of strength with the minimum of cost, and if this assumption be justified by experimental results, it follows at once that the proportioning of concrete-forming materials is of the utmost importance. Greater strengths can be obtained by the use of excess of cement, as in the case of the ordinary mix of 1:2:4, but the increase in strength is less than the increase of cost of materials, and is, therefore, only justified in particular cases.

The strength of any concrete will depend not only upon the materials and their proportions, but also upon the method of using those materials. Any void in a mass of ¾-in. coarse material may be filled in many ways. First, it may be filled with cement and sand and mortar, as in the 1:2:4 concrete; secondly, it may be filled with a piece of stone which practically fills the whole space; and, thirdly, it may be filled with a number of stones which vary in size with a minimum amount of cement-and-sand mortar. The first filling is composed almost wholly of joints, and on that account is weak; the second filling is strong, owing to the absence of joints, but it is impracticable; but the third is a compromise which is not only practicable, but also strong. It will be seen that the amount of the variations in size or the grading will depend upon the nature and quality of the work required. On the one hand there will be good but costly filling, and on the other a cheap but still good filling, and whether the graduation be large or small the filling will be better than one of cement-and-sand mortar only.

With a view to testing the effect of proportioning upon the strength and other properties, and also the cost of concrete, the authors drew up a series of experiments, the intention being to test compressive strength, modulus of rupture, specific gravity, water resistance and fire resistance. Various difficulties arose in the course of the work which not only prevented the paper being presented on the original date, but prevented also the inclusion of specific gravity, water resistance and fire resistance tests. The series involve 216 test pieces, to which must be added others prepared for water and fire resistance and specific gravity tests, but which could not be tested in the time available. The voids were measured in a patent apparatus designed by Mr. Davenport, which gives results to 1-5 of 1 per cent. The preliminary data comprised tests on Portland cement, size of granite chips, volume of chips per batch, percentage volume of voids in chips, sizes of river sand used, volume of sand used per batch, percentage volume of voids in sand, and the volume of cement used per batch. Regarding the last-mentioned item, it must be noted that no allowance was made for the excess cement required for jointing, only the amount required to fill the voids being used. Had time permited it, the correct allowance in each case would have been ascertained, and additional tests made therewith. The limited time made it impossible to test the cement before using it for the concreted test pieces, the brand only suggesting its probable good qualities.

The batches were hand mixed by engineering (senior honours) students, and as no special means of testing the thoroughness of the mix were adopted, the resulting concrete will probably compare favourably with machine mixed so far as uniformity of results go. Every care was exercised, however, in the mixing to get all the materials thoroughly intermixed and apparently uniform. This proved to be the case when the specimens were tested. The moulds were made of planed boards, bolted together with gangs, damped before using, and lined with paper on the under side to facilitate removal. In spite of this, several pieces were damaged in removal, due more particularly to the relatively small sections used.

Immediately after mixing the moulds were filled and left in a tool shed till required for testing. They were wetted regularly every three or four days.

It was found that the ratio of compressive to tensile strength varied more in the one-month than the three-month tests, and is not sufficiently uniform to base any conclusions upon beyond the fact that such ratio is not constant. It is considered by the authors, however, that this ratio should be more or less constant as the failure, whether compressive or tensile, depends upon the adhesive strength of the cement.

The ratios strength at three months to strength at one month were more or less uniform, more particularly in the case of compressive strengths. In the case of 1:2:4 concrete the modulus of rupture appears to increase more rapidly than the compressive strength, while in the other series with cement accurately proportioned, the compressive strength increases more rapidly than the modulus of rupture, as out of six series only one runs the other way, probably due to rather dry mixing of those three-month test pieces.

Although the cement tests are unsatisfactory, it will be possible to compare the strength and costs of the concrete in the different series, as they will probably all be affected to the same extent. The most important point brought out by such comparisons is the fact that for accurate proportions, the ratio of the cost of the cement compared with the total cost is practically constant for all gradings taken in the tests, so that when the graded coarse material is used the total cost need only be further considered. Of course, the total cost is always the final criterion as regards economy, and it may be suggested that the ratio cost of cement to total cost need not be considered. But the relative values of total cost obtained may be altered when additional tests are made at other ages, and it is difficult to say whether they will be affected by the ratio; so that, if it can be shown conclusively that this ratio is constant, or nearly so, the total cost, age and proportions need only be dealt with.

The San Gabriel River bascule bridge near Los Angeles has a 187-ft. Scherzer rolling-lift bascule span with double-web segmental girders weighing 55,000 lbs. each. The flanges curve through an arc of nearly 90 deg. with a radius of more than 30 ft. and were planed by an ordinary machine-shop lathe with its tool-stock connected to the girder by a cable. The girder was laid flat on a pair of curved rails and rigidly attached by timbers to a pivot in a small concrete pier at the centre of the curve. The cable was arranged so that the feed of the lathe would pull the girder in a circle around the centre of the curve. By means of its adjustment and a belt from a motor over a large pulley the lathe was given a very slow speed and pulled the girder against the tool of a milling machine, which accurately finished the curved surface. The work was supervised by Samuel Murray, bridge engineer of the Oregon-Washington Railroad & Navigation Company, and was described by him in a paper on "Some Types and Features of Movable Bridges," presented to the Pacific North-west Society of Engineers.

Status and Prospects of the Steel Trade in Canada

The present status and future prospects of the Canadian steel trade are the subject of an interesting article by a correspondent of the London "Engineer," who writes:

"After many ups and downs the Canadian steel industry seems to be entering upon a more settled and prosperous career. It is only some twelve years since Canada's iron and steel making resources were described as inferior on very high authority, but recent discoveries of rich and well-situated deposits of coal and iron ore have improved the outlook. These discoveries, coupled with changes in the tariff, the appointment by the government of a special commission to consider the question of renewing the iron and steel bounties, with a fairly reasonable prospect that they will be renewed, and the building of large works by the American Steel Trust, together with extension by the existing Canadian companies, are circumstances seeming to combine to give the Dominion's industry a new lease of life.

"In spite of liberal government bounties from 1884 to 1910, and in late years a fairly high protective fiscal policy, the financial results of Canadian iron and steel enterprises have been very poor. But now the signs of a complete change are fairly abundant, while the erection of vast works by the American Trust is both interesting and significant. The Steel Trust people have had one or two bad disappointments in Canada. About ten years ago the Canadian Government was thinking of putting a tariff of $7 per ton on imported steel rails. At that time the native steel industry was assuming considerable proportions, two or three large rail mills being in course of erection, but these concerns were threatened by an American Steel Trust "dumping campaign." It was then that the Dominion Government added its famous "anti-dumping" clause to the Tariff Act. In consequence of that notable clause, the Steel Trust directors began to consider the question of erecting works of their own within the Canadian tariff wall. Even at that time the Trust was exporting 200,000 tons of steel products to Canada annually. Not only was it a question with the Trust of saving the import duty by producing for the Canadian market in Canada instead of the United States, but there was the added prospect of enjoying the bounties on iron and steel production that were paid by the Canadian Government. For example, a bounty of $1.70 per ton was paid in respect of the production of pig iron, with an additional $1.05 on raw steel, and higher payments in respect of more highly finished goods. But when the Steel Trust appeared in Canada and purchased 1,000 acres of land at Sandwich, Ont., a fear was inspired that the struggling Canadian enterprises might be squeezed out by the big Trust from the States. There was certainly a danger that the American Trust would manipulate the Canadian tariffs and bounties not only to strengthen its position in the Dominion market, but for the purpose of fostering an export campaign. Had that idea materialized it would have been rather serious for the British steel trade. We should have had the spectacle of American Steel Trust exports from Canada, substantially bounty-fed by a British Colony, competing with British products in the world's markets.

"It was then that Canadian statesmen, put on their guard, introduced a new and notable feature in the bounty law. In introducing the Bounty Bill in 1907, the Finance Minister, Mr. Fielding, laid down the new policy as follows: 'We propose,' he said, 'that these bounties shall not apply to iron and steel that is exported. There are rumors that the great Steel Trust of the United States may come to Canada to do business. If it comes in the ordinary way, well and good; but if it comes here to make iron and steel for export, it may add largely to our burden. We think it is well to have it understood that we are giving these bounties for the encouragement of iron and steel production for consumption in Canada, and if any concerns undertake to export iron and steel goods they shall not be entitled to the bounties on them.'

"Had it not been for that special stipulation, it is almost certain that the Steel Trust would have immediately proceeded to erect works in Canada, and would before now have been exporting bounty-fed steel goods into this country, among others. In all the Bounty Acts prior to the appearance of the American Trust on the scene—that is to say, in all the Bounty Acts between 1883 and 1903—the provision was simply that payments be made in respect of certain iron and steel goods produced in Canada. The export trade was not considered, for with the exception of a small quantity of pig iron sent to Scotland in 1897 nothing of this kind was exported from Canada; but the advent of the big American Trust altered the situation, and it was therefore provided in the next Bounty Bill—that of 1907—that the bounties be paid only in respect of goods consumed as well as produced in Canada. Most of the bounties terminated in 1911, owing largely to the opposition of the farmers, the general idea being that the steel industry could support itself, and there was no renewal of these special favors. But in response to a persistent agitation by the Canadian steel manufacturers, the Government has appointed a special commission to inquire into and consider the question of a re-introduction of the bounty system. After a great deal of uncertainty, the steel tariff has been placed upon a reasonably protective basis, and it is not altogether unlikely that the manufacturers will again enjoy bounties, for Canadian statesmen are anxious to see the mineral as well as the agricultural resources of the Dominion developed.

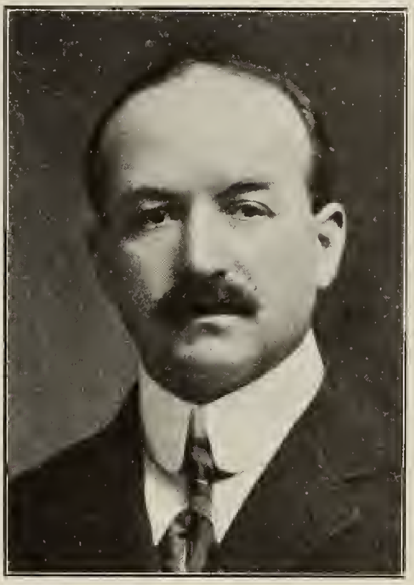
"The stipulation by the Canadian Government in 1907 that the bounties were not to be paid in respect of any goods that might be exported, coupled with the probability that the bounties would not be renewed in 1911, upset the designs of the American Steel Trust, and the proposed Sandwich enterprise stood in abeyance, although Mr. Farrel tried to persuade his co-directors to proceed with the business in 1909, contending that unless the Trust began to manufacture for the Canadian market within the Canadian tariff wall their share of the trade in the Dominion might be lost to the rapidly growing works of purely Canadian concerns.

"Mr. Farrel's advice was not taken at the time. Now, however, it is announced that the American Steel Trust is to spend at least $20,000,000 in erecting modern blast furnaces, steel works, and rolling mills on the Sandwich site. With vast reserves of coal and iron ore and a rapidly growing market, it may be that within the next generation there will be built up in Canada an iron and steel industry second only to that of the great United States."

Canadian Contractors and Their Work

Mr. Wm. Lyall

MR. William Lyall, the president and managing director of the P. Lyall and Sons Construction Company, Limited, Montreal, is a Scotchman by birth—he was born in 1866 in Castletown, Caithness—but has lived the greater part of his life in this country. He was brought to Canada by his father, the late Peter Lyall (the founder of the firm) at an early age, and was educated in Montreal. He has been connected with the building trade all his business life. In 1881 he was appointed to his father's business, and continuing in the same line, was made managing director of the firm, then known as P. Lyall & Sons, Limited, of which the late Mr. P. Lyall was president. When stock in the enterprise was open for public subscription the name was changed to its present form. Mr. William Lyall was elected president, and is now head of the largest contracting firm in Canada. Mr. Lyall is a very busy man, for he is a director of the Sterling Bank, managing director of the National Brick Company, director of the City Land Company, president of the Wallace Sandstone Quarries Company, director of the Ontario National Brick Company, besides being financially interested in many other leading Canadian corporations. He is a member of the following clubs: The Manitoba, Winnipeg; the Engineers, Canada, Caledonia Curling, St. Lawrence Yacht and Beaconsfield Golf, all of Montreal; also of the M. A. A. Association and the Masonic Fraternity. In addition, Mr. Lyall is a member of the Montreal Board of Trade, and a trustee of the Western Hospital. He is married, and has six children.



Mr. Wm. Lyall, Contractor, Montreal.

At Edmonton, operations have commenced upon an addition to the hospital at an estimated cost of $120,000. The architect is Mr. R. W. Lines and the general contractors are Messrs. Olson & Johnson, Edmonton. The addition is to be three storeys high, of brick construction.

Construction is to start immediately on an office building estimated to cost $600,000 for the Prudential Trust Company, Limited, Winnipeg. The building will be thirteen storeys high, of stone, steel and reinforced concrete construction. The architects are Messrs. Ross & Macdonald, and the general contractors Messrs. Carter, Halls-Aldinger Company, both Winnipeg firms.

The Late Dean Galbraith

It is with profound regret that we have to announce the death of Dr. Galbraith, Dean of the Faculty of Applied Science of the University of Toronto, which occurred suddenly at his summer home on the Georgian Bay on July 22.

The late Dr. Galbraith was a man whose genial, unassuming personality had endeared him to two generations of engineers. Only last December, members of the profession from all parts of the North American Continent gathered together in the Engineering Building of the University of Toronto to pay tribute to his worth and work on the occasion of the fiftieth anniversary of his entrance as a freshman. Upon that occasion one of the speakers aptly referred to him as "the Dean of Engineering in Canada." It is in this sense that Dr. Galbraith will best be remembered.

The late John Galbraith, M.A., L.L.D.

Dr. Galbraith was born in Montreal in 1846 and received his early education at Port Hope, Ont. Entering the University just fifty-one years ago, he graduated B.A. in 1867 and M.A. in 1868. Since that time the honorary degree of LL.D had been conferred upon him by a number of universities. His early engineering experience was obtained on engineering and survey work on the Midland Railway as assistant to the Chief Engineer. Later he was engaged on Intercolonial Railway construction. In 1878, upon the founding of the School of Practical Science, he was appointed to the Chair of Engineering. He became Principal of the School in 1889 and retained that post until 1906, when he was made Dean of the Faculty of Applied Science. He was one of the founders of the Canadian Society of Civil Engineers and was President of that body in 1909. A signal honor was conferred upon him a few years ago when he was made a member of the Quebec Bridge Enquiry Commission.

The late Dean Galbraith was a man of that genius which has been described as "an infinite capacity for taking pains." This capacity exerted in his earlier days gave him in his later years the mature judgment which placed him in the foremost ranks of the engineering profession. He was known to engineers old and young from one end of the country to the other and was beloved by all. His disposition had never become warped by close application to academic or professional work and he had at all times that human touch which is productive of affection which few men enjoy. He was always charitable, always patient.

For some time the late Dr. Galbraith had been failing, but the shock of his sudden death was little less acute. His place on the University staff will be hard to fill, while the vacancy which he has left in the hearts of countless engineers from coast to coast will never be filled. The name of John Galbraith will occupy a place by itself in the annals of engineering in Canada.

Personal Mention

Mr. M. C. Macfarlane has resigned the position of Resident Engineer of the Montreal aqueduct extension.

Mr. John M. Ver Mehr, head of the John Ver Mehr Construction Company, Toronto, is at present on a business trip to England.

Mr. Chas. Harper, B.A., has been appointed professor in charge of the Department of Science at Moose Jaw College. He was formerly attached to the Research Laboratory of Queen's University, Kingston.

Mr. George W. Brittnell has been appointed sales representative for Eastern Ontario of the Palmer Lime and Cement Company, 103 Park Avenue, New York City. The company handles hydrated lime, and amongst the trade Mr. Brittnell is well known throughout Ontario. The Eastern office is with the Builders' Exchange, Goodyear Building, Toronto.

Mr. George Janin, Chief Engineer to the Montreal Council, has received an increase of $2,000 to his salary, making it $9,000 per annum. A few weeks ago Mr. Janin declined an increase of $1,000 on the ground that it was inadequate. Mr. Janin will now be in direct charge of the waterworks improvements. His health is by no means good, and it is probable that he will retire in a few months, but he is desirous of seeing the waterworks extension carried out before he resigns.

Mr. Archibald Currie, City Engineer of Ottawa and formerly of Westmount, who is resigning the Engineership of the Federal Capital.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The Chatham City Council is considering the question of appointing a building and plumbing inspector and the drafting of a by-law to define his duties.

The Shamrock Amateur Athletic Association, at Montreal, contemplate the erection of a grand stand at an estimated cost of $200,000, and will appoint an architect shortly.

Messrs. Foley & Gleeson, Ottawa, were the successful contractors for paving work at Kingston, Ont., estimated to cost $125,000. The contract comprises 50,000 square yards of sheet asphalt on concrete base.

Tenders will be called in September for a grandstand to be erected at Quebec City at a cost of $100,000. The construction will be fireproof, of reinforced concrete and steel. The architect is Mr. J. H. Pinsonnault.

Operations are now in progress on the new building which is being erected at Notre Dame de Grace, Montreal, for Loyola College, according to plans prepared by Messrs. Peden & McLaren, architects. The general contractors are Messrs. Anglins, Limited, Montreal.

The Montreal Board of Control have appointed Mr. Eugene Payette architect for a civic library on Sherbrooke Street East. The cost will be $200,000. It was originally intended to have received competitive plans, but the idea of a competition has been abandoned.

The Dominion Savings Company are to erect an office building at London, Ont., at a cost of $200,000, and the razing of the old structure has been completed. The new building will be four storeys high, of steel and brick construction. Mr. W. G. Murray is the architect.

The contractors have completed the excavation for the Assembly Hall which is to be erected at Montreal for St. Patrick's Parish at a cost of $135,000. The new building is to be of stone, steel and reinforced concrete construction. The architect is Mr. J. P. Hynes and the general contractors are Messrs. John Quinlan & Company, Montreal.

Foundation work has been completed on the new church which is being erected at Montreal for St. Michael's parish. The architects are Messrs. Beaugrand-Champagne & Chenevert and the general contractors the Atlas Construction Company, Limited, both of Montreal. The building will be of stone, brick and terra cotta construction.

Work on the new waterworks pumping station at Sarnia, Ont., is progressing rapidly, the contractors, Messrs. Guttridge & Grace, having completed the construction of twenty-one of the twenty-four infiltration basins. The building itself has been completed and the pumping engines and boilers are being installed. The entire cost of the scheme is estimated to approximate $250,000.

Work on the construction of the new government breakwater at Kincardine, Ont., has advanced so rapidly that it is anticipated the six hundred feet under contract will be completed this fall. The lake bottom is said to be of very hard clay, with boulders that make difficult the work of preparing a suitable foundation. Dredging the bottom for the laying of the cribs has commenced and five strongly-built wooden cribs are at present in the harbor ready to be towed out and sunk, after which they will be filled with stone until three feet from the lake level, when cement concrete will be used to build the upper structure.

Although the construction of the dry dock at St. Joseph de Levis, Que., was commenced as recently as May last, rapid progress is being made by the contractors, the M. P. & J. T. Davis Company, who have more than two hundred workmen employed at the site. The dock will be 1,150 ft. long, 120 ft. wide and about 70 ft. deep. The structure will be of concrete and granite. The dry dock will be able to accommodate the largest ships afloat.

Of the many evidences of building development in Toronto not the least conspicuous is the approval on the part of the City Council of a scheme for the re-organization of the City Architect's Department. Besides a request for increased and better equipment for the architect's offices, the plan calls for the appointment of six additional building inspectors, three plan examiners, two clerks and a stenographer.

The Canadian Vickers Company, Montreal, will commence in August the construction of what promises to be the second largest ice breaker in the world. The vessel, which will be constructed at the Maisonneuve plant at a cost of one million dollars, is to be used by the Canadian government for ice breaking in the River and Gulf of St. Lawrence. It will be of the heaviest type of construction and the following dimensions: length 292 ft., width 66 ft., draft 19 ft. The equipment will include 8,000 h.p. engines. It is to be ready for launching next May. Close on 900,000 feet of Southern pitch pine is on the way to Montreal from Georgia for the purpose of erecting the launching ways.

The municipalities in the Welland Canal zone have failed to agree regarding the basis of apportioning the cost of the pipe line from Port Colborne to the reservoir at St. Catharines. The Hon. Frank Cochrane, Minister of Railways and Canals, conferred recently with representatives from St. Catharines, Welland, Thorold and Merritton, apparently without success. The total cost is estimated to exceed one million dollars, of which the government will contribute more than one-half. Mr. Cochrane proposes the distribution of the cost as follows: St. Catharines, $275,000; Welland, $95,000; Thorold, $90,000; Merritton, $35,000. It seems doubtful whether this contributory scheme will meet with the approval of the various interests concerned.

The Quebec Board of Health sanitary survey of the Richelieu River from Sorel to Rouse's Point has been completed under the direction of Mr. Theo. L. Lafreniere, sanitary engineer, with Doctors A. Corsin, R. Gautheir, and H. Sanson, district medical inspectors. Thirty-four sampling stations were established. Less contamination in the river was found above St. Johns, P.Q., owing to the smaller number of inhabitants, but from St. Johns to Sorel a steady increase of contamination was found in the river, from which the villages and municipalities take their water. All the Richelieu River water supply should be thoroughly purified, says Mr. Lafreniere, who will suggest in his report as the most economical method that filtration plants of the gravity type be installed, and that the water be further purified by hypo-chloride.

The course in Architecture leading to the degree of Bachelor of Architecture at McGill University has been increased from four to five years. The change has just been announced by the University Corporation in the Calendar and is made because a thorough education is aimed at. Hitherto, the course has been sufficient to give a student a thorough education in Architecture, but to include all subjects it meant a great deal of work. In treating of the change in the course, the Calendar says: "The object of the curriculum in the first year is to impart such general culture, scientific knowledge and skill of hand, as will prepare the student to profit by the work of the succeeding years. An arrangement has been concluded between McGill University and the Province of Quebec Association of Architects whereby holders of the Bachelor of Architecture degree are admitted to practice in the province, after spending one year in the office of a member of the Association, and passing an examination in Design, instead of having to take the regular prescribed entrance examinations. The office experience may be gained by working in the summer vacations."

St. John, N.B., Development

The plant of the St. John Milling Company at West St. John, which was destroyed by fire recently, involving a loss of $20,000, will be rebuilt at once. This was one of the most successful milling plants in the province.

A great scheme of development and reclamation is in progress on the western side of St. John harbor, the purpose being to provide berths the coming winter for some of the larger ocean steamships of the Canadian Pacific Railway and other lines. Four hundred men, five tugboats, three dredges, two locomotives and trams and four reclamation plants are engaged in this stupendous undertaking. The contractors are the Maritime Dredging and Construction Company, who have sublet to Cape & Company and D. C. Clark. Unless something unforseen arises, the contracts will be completed in time.

Two schemes for the erection of large hotels are in progress at St. John. One provides for a nine-storey hotel on Germain street, occupying the space between Princess and Horsfield streets. It will be called the Hotel Carleton, and will be fashioned after the style of the new Vanderbilt Hotel, New York. Hon. William Pugsley, of St. John, and Mr. Thos. W. Lawson, the well-known Boston financial man, are among the promoters of this enterprise. The second hotel scheme is of even greater magnitude. It covers the erection of a mammoth hotel on the north side of King square, one of the finest sites in the whole city. Mr. C. H. Cahan, of Montreal, is among those interested in the construction of this hotel.

In pushing forward the harbor and industrial development at East St. John, N.B., three hundred workmen, one powerful suction dredge, three high-power elevator dredges, an ocean tug, five locomotives and ballast trains, two steam shovels and other accessories, are constantly employed by the Norton-Griffiths Company. The firm have almost completed an immense breakwater of stone. They have reclaimed over twelve acres of land for a ship repair plant, have excavated about one-third of the site for a dry dock, and have made considerable progress in dredging berths inside the breakwater for ocean commerce and in widening and deepening the entrance channel. Next spring they expect to begin the construction of concrete and steel cylinder quays for ocean berths, and a pier at the entrance to the dry dock. Their contract, which expires in 1917, covers the supplying of twenty-three steamship berths and involves an expenditure of over thirty million dollars. It is expected that this particular point will be utilized by the Grand Trunk Pacific Railway.

WESTERN CANADA

The government appropriation for dry docks and harbor improvements at Victoria, Vancouver, and Prince Rupert amount to about $15,000,000.

The Pacific Lock-Joint Pipe Company are proceeding rapidly with the construction of a 28-mile conduit, 42 ins. in diameter. The pipe line, which will be reinforced concrete, is in connection with the Victoria, B.C., water supply.

The erection of the new residence at Regina for the Lieutenant-Governor of Saskatchewan will not be started until next spring. Plans have been prepared by Messrs. E. & W. S. Maxwell, Montreal. The building is estimated to cost $150,000.

The first shipment of Western Canada reinforcing bars ever made by water by the Dominion Iron & Steel Company is at present on its way from Sydney to Victoria, B.C. The cargo consists of 5,000 tons of rails for the C. N. R. and 1,000 tons of concrete reinforcing bars for the Victoria piers.

The Winnipeg and St. Boniface Harbor Commission learns that the Canadian Parliament has passed an appropriation of $200,000 for harbor improvements on the Red River at Winnipeg and St. Boniface. Work on the docks will be proceeded with as soon as possible, and the commissioners believe that dockage facilities sufficient to handle the traffic will be ready before the close of navigation.

Plans for a Dominion government drill hall, which is to be erected at Vancouver at an estimated cost of $350,000, have been prepared by Messrs. Perry & Fowler, of Vancouver. The dimensions of the building are 278 ft. by 174 ft. The drill hall proper measures 225 ft. by 120 ft., extending to the roof of the building with a sweeping arch above. The company armouries and officers' rooms will surround the building and a swimming pool, gymnasium, miniature rifle range, bowling alleys, etc., will be provided in the basement.

Damage estimated at between four and five thousand dollars was done to the Pipe Fabricating plant operated by the Burrard Engineering Company, at Thetis Cove, Esquimalt Harbor, on July 8, by a fire which resulted from the ignition of inflammable material in the dipping tank. The plant was leased by the Burrard Engineering Company and was formerly owned by the Westholme Lumber Company, original contractors on the Sooke Lake work. It is announced by Mr. Bird, president of the company, that pipe fabrication is proceeding and that the only delay occasioned is in connection with repairs to the dipping tank.

A distinct sign of the times in regard to railroad and bridge development in Western Canada, is the announcement that the Saskatchewan Bridge & Iron Company, of Moose Jaw, are erecting an addition to their plant in the west end of the city, which will be 120 ft. by 75 ft. and will be used as a foundry, machine shop and pattern room. It will be of steel and brick construction. Work is proceeding on the foundations and the superstructure will be erected without delay. This company have already extended their operations into Alberta, and the steel frame of a new factory at Medicine Hat has been constructed.

The residents at Swift Current, Sask., are apparently convinced of the soundness of the town planning idea. A public meeting was held on July 15, at which addresses were delivered by Mr. Malcolm Ross, Provincial Government Landscape Artist, and Mr. Mawson, of T. H. Mawson & Sons, town planning experts. The matter is not to be allowed to rest as the City Council has been requested to engage the services of a qualified town planner to prepare a comprehensive plan for the location and development of public buildings, parks and playgrounds, the solution of railway grade, station and subway problems, sewers, lay-out of streets and all public works. The matter has been taken up with enthusiasm by the people of Swift Current, who are desirous of coming into line with the other cities and towns in the Dominion in the matter of city planning.

Harbor improvement work at Victoria, B.C., has been the most extensive in any city on the coast within recent years. The inner harbor has been made the most of, but its size limits its use particularly to the coastwise and ferry-boats. For accommodation of deep-sea vessels, whose business at Victoria is steadily increasing, the problem was the development of the outer harbor, a semi-circular arm of the sea leading in from the Strait of San Juan. This necessitates construction of a breakwater at the entrance, part of which will form one of the Dominion government piers. This breakwater is to be 2,550 feet long. The government work will consist of four piers inside the breakwater and contracts for the construction of two of these piers known as piers 2 and 3 have been let. These piers will be about 1,000 feet long and 250 feet in width and construction will be of concrete. The depth of water alongside will be between 50 and 60 feet. Excavation work has been going on for some time. The initial expenditure upon this project by the government is $2,500,000.

A reinforced concrete sewer, which will drain a section of the city 425 acres in extent, also 800 acres in Saanich and 1,000 acres in Esquimalt, is under construction at Victoria, B.C. The sewer will be two miles long when completed and will discharge into an outfall near Macaulay Point, where it will empty through several hundred feet of steel pipe at a point below water level where the tides admit a favorable disposal. The trunk sewer is 27 ins. in diameter at its beginning, increasing to 36 ins. at the outfall. The sections of reinforced concrete pipe are cast in five-foot lengths. The excavation for the sewer consists of about 7,250 ft. of rock tunnel and 3,100 ft. of open work. The tunnel work maintains a depth of 65 ft. below the surface and consists essentially of three separate tunnels, the first of which is now being driven, and in connection with which two shafts have been sunk. The tunnel will be five feet in width and seven feet in height. The excavation material is mainly solid rock and admits of an average daily progress of five feet. Mr. A. E. Forman, assistant to Mr. C. H. Rust, City Engineer of Victoria, has charge of the work.

Canadian Railroad Development

Construction work on the Kamloops-Okanagan Branch of the Canadian Northern Railway is expected to commence shortly. Mr. S. H. Sykes, assistant-chief engineer of the company, visited Vernon, B.C., recently, for the purpose of conferring with a special committee of the City Council with reference to crossings, bridges and the route of the projected line through the city park.

Hearst, a divisional point on the National Transcontinental Railway, some distance west of Cochrane, Ont., was wiped out by fire on July 16. The town contained some six or eight hundred inhabitants, and most of the dwellings were of wood construction. There were the divisional offices of the Transcontinental Railway, a large cement roundhouse, and the offices of Messrs. O'Brien, McDougall & O'Gorman, railroad contractors, who had their headquarters at Hearst.

The grading of the Patricia Bay branch of the Canadian Northern Pacific Railroad, and also of the main Vancouver Island line, has advanced to such a stage that preliminary arrangements are being made for the laying of steel. Tenders will be invited immediately for the construction of a temporary wharf, 40 ft. in length by 64 ft. in width, at Patricia Bay, capable of accommodating at low water a vessel drawing 24 ft. Steel for the contract will be obtained from the Dominion Steel & Iron Company.

Steel laying on the new Weyburn-Lethbridge branch of the C. P. R. is now extended to the Alberta boundary line, the work having been advancing steadily during the summer at the rate of about three miles a day. When completed the line will be about 410 miles long. In addition to the construction work on the Weyburn-Lethbridge line the C. P. R. is also double-tracking the main line between Regina and Broadview, and two gangs of men are working, one between Regina and Indian Head, and the other near Grenfell. Operations are expected to be completed in September, by which time the company will have a double-tracked line practically all the way across Saskatchewan.

An ambitious scheme for handling the railway traffic at Montreal has been planned by one of that city's Controllers, Mr. Herbert. The scheme briefly consists of the construction of a Union Station to receive the traffic of the C. P. R., the C. N. R., the G. T. R., and other lines with running rights; the construction of an overhead line along Common street to receive the traffic from the old Victoria bridge; the construction of a subway between the proposed Union Station at Mile-End and the removal of the C. P. R. tracks along the water front; the construction of a subway to connect with the C. N. R. tracks and the removal of Moreau street station, and the purchase of Bonaventure station and the right-of-way to St. Henry, with the removal of the present tracks. It is proposed that the enterprise, which has not yet been submitted to the City Council, shall be municipal and administered by a special commission.

Edmonton Notes

Permits for buildings valued at $740,750 were issued in Edmonton in June, bringing the total to $3,562,847 for the first six months of 1914.

Mr. George O. Sanburn, of Seattle, has come to Edmonton to establish a sweater factory and will erect a plant, which is to be in operation next fall.

Messrs. Brown & Hargraves, builders, and Ross Brothers, Limited, plumbers, have received contracts, involving $78,228, to erect an eight-room addition to Rutherford School in Edmonton.

Good progress is being made on the ten-storey business block which is being erected at Edmonton for Mr. K. McLeod of that city. The estimated cost is $450,000. Messrs. Olson & Johnson, of Edmonton, are the general contractors.

Two and a half million dollars will be expended by the municipality of Edmonton in completing its improvement programme for 1914. To provide the funds, the city council has adopted the report of Mayor McNamara, finance commissioner, to issue $4,500,000 worth of 4½ per cent. treasury notes. The necessary by-law has been passed by the council.

Mr. W. R. Smith, chief engineer of the Alberta and Great Waterways Railroad, 280 miles long, now under construction between Edmonton and Fort McMurray, announced in Edmonton that 1,100 men are at work on the grade, which should reach Lac la Biche in October. Fourteen miles of grade is completed. The road is being built under the direction of the Government of Alberta.

Seventy-five thousand dollars is the estimated cost of the Exchange building that is being erected for Mr. John Kelly at Rice Street and Howard Avenue, Edmonton, by the Zenith Construction Company, from plans prepared by Van Sicklen and MacComber, architects. The structure will be four storeys high and contain six stores and sixty office rooms and 6 11-foot basements. Reinforced concrete and brick will be used.

Mr. W. D. Van Sicklen, architect, has completed plans for a seven-storey office building to be erected in Jasper Avenue, Edmonton, for Hon. Wilfred Gariepy, minister of municipal affairs for Alberta, at a cost of $200,000. It will be of reinforced concrete, with a frontage of 80 feet in Jasper Avenue and a depth of 90 feet. The exterior will be red brick and terra-cotta, and the interior will embody the latest ideas in office accommodation. Work will begin in August.

The Deputy Minister of Public Works for Alberta says, in his annual report, which is to be issued in a few weeks, that 316 wooden bridges and 16 steel spans were constructed by the department in Alberta during 1913, also that 98 bridges were repaired. Eleven ferries were built and installed and six ferry scows were replaced with new craft. Sixty ferries are now in operation. A large amount of trunk road work was completed. Aside from this, the department reports the completion of the parliament buildings in Edmonton, the erection of the government house in Edmonton, the land titles building in Edmonton and agricultural schools at Olds, Claresholm and Vermillion. The work in the surveys branch showed an increase over previous years.

Firing tests of native shale, now being made in Canada and the United States, will determine whether the city of Edmonton will add a $1,000,000 plant, financed by British capital, to the local industries. The firm is represented in Canada by Montreal capitalists. Tile and brick will be the chief products of the establishment. The Edmonton Industrial Association and Mr. George M. Hall, industrial commissioner for Edmonton, are working on the proposition. All that remains is to prove the commercial value of the shale by expert firing. Tests have been made in this direction and the results are reported to be highly satisfactory. The shale is grey and has passed through the oxodization state. The deposit, said to contain millions of tons, is within eight miles of the city.

The Cement-Gun is described in detail in an interesting book compiled and edited by Arthur E. Lee, General Manager of the Cement-Gun Company, Inc., New York. The object of this book is to give a fairly comprehensive idea and description of the Cement-Gun apparatus, the prices, the product, and the various applications to engineering and constructional operations. The book is profusely illustrated with excellent half-tones.

Fittings, Limited, of Oshawa, Ont., are well-known manufacturers of Diamond Brand pipe fittings, malleable and cast iron fittings, including cast iron recessed drainage fittings. The fine grey iron castings manufactured by this firm are favorably known to the trade, as also are the sash weights and cast washers, of standard size, and detachable chain link belting. The company, whose headquarters are at Oshawa, also carry on operations at Montreal, Winnipeg, and Vancouver, so that their products are familiar to the building trade all over the Dominion.

The Ebsary Fireproofing Company, Toronto, have carried out a number of extensive contracts for gypsum fireproofing recently. One of the most important of these has been the fireproofing work in connection with the new Royal Bank building in course of erection on the north-east corner of Yonge and King Streets, Toronto. About 400,000 square feet of the material was put in, and the fact that it was handled in something like forty-five working days reflects creditably upon the enterprise of this firm. Another recent contract put through by the company was in connection with the new Orphanage at Oakville, Ont., for the Independent Order of Foresters. In this building gypsum fireproofing, which was manufactured in Caledonia, Ont., is used in the partition walls throughout the building. Not only is it absolutely fireproof, but it is claimed to be one of the greatest non-conductors of sound. Conspicuous among the buildings for which the Ebsary Fireproofing Company have supplied gypsum fireproofing may be mentioned the following: The Fort Garry Hotel, Winnipeg; the MacDonald Hotel, Edmonton; and the Ritz-Carlton Hotel, Montreal. The manager of the company is Mr. F. S. Bridges.

A number of good contracts for flooring material have been obtained by Messrs. Canada Floors, Limited, according to information to hand from Mr. F. Shaw, the firm's manager at Montreal. The list of new buildings includes the following:—St. John the Evangelist's School, Pointe St. Charles; Notre Dame School, Three Rivers; Kensington School, Notre Dame de Grace, and the William Trenholme School at Rockfield, P.Q., also new Catholic schools at Montreal, Longue Pointe, and Notre Dame de Grace. The various lines manufactured by Canada Floors, Limited, comprise Canada Mosaic Floors, Magna-Asbestos Floor, Canada Mastic Floors, Asphalt Waterproofing and Asphalt Roofing.

Awards have been made in the competition announced several months ago by the Barber Asphalt Paving Company, for papers from engineering students on the subject of Asphaltic Materials for Highway Construction. The judges of the competition, Mr. E. J. Mehren, Editor Engineering Record, and Mr. H. P. Gillette, Editor Engineering and Contracting, have made awards of prizes of $100 each to the following contestants: Frederic O. X. McLoughlin, Columbia University; Harry Schindler, Cornell University; B. J. Fletcher, University of Georgia; John W. Hill, University of Illinois; Robert S. Johnson, Iowa State College; M. V. Holmes, University of Kansas; F. P. Gilbert, Massachusetts "Tech."; Harold J. LaLonde, University of Michigan; Benjamin Wilk, University of Minnesota; Alvin C. Smith, University of Nebraska; O. H. Gosswein, Purdue University; Alfred A. Berkowitz, Scheffield Scientific School; W. J. Campbell, Syracuse University. The purpose of the competition was to turn the attention of engineering students to street and road construction as a promising field of work. The company offering the prizes believes that the plan was successful in this direction.

New Exhaust Steam Heating Encyclopedia

The Harrison Safety Boiler Works have recently put forth for distribution their new 207-page edition of the Exhaust Steam Heating Encyclopedia, which should prove a valuable addition to the library of any engineer. It contains much information on the use of exhaust steam for heating, the result of many years of careful study. It illustrates and describes some twenty-eight different commercial systems of exhaust steam heating, showing at the same time the application of the new Cochrane steam stack and cut-out valve heater thereto. It is claimed on behalf of the Cochrane heater that it contains the latest improvements in the design and construction of the open type feed water heater, especially where used in conjunction with steam systems. In this connection the application of the enlarged oil separator and cut-out valve simplifies the piping arrangement, thereby reducing the cost of installation. The special application of the Cochrane steam heater to condensing plants and low pressure steam turbines and ice and refrigerating plants; the "V" notch weir for the measurement of hot boiler feed water; and the Cochrane multiport safety exhaust outlet valve for the control of the pressure and exhaust steam heating and drying systems, are fully described.

Tables and information relating to exhaust steam heating, data on temperatures and heat losses, tables on the properties of air and steam, heat transmission for low pressure steam, together with data for hot water heating with forced circulation, are also contained in this edition.

The Canadian Allis-Chalmers, Limited, as the sole agents for Cochrane apparatus, will supply copies of this catalogue to engineers on application.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brampton, Ont.

The town council has instructed the engineer, Mr. Wm. M. Treadgold, to call for tenders on a number of sewers. The estimated cost is $13,750.

Barton Twp., Ont.

The construction of a sewerage and water system is being considered by the township council. Mr. J. B. Nihcolson, of Hamilton, is the engineer.

Bertie Twp., Ont.

Tenders will be received by the township clerk, M. S. Pound, Ridgeway, until July 31st, for the construction of 1½ miles of macadam, cement, rocmac or tarvia roadway.

Bobcaygeon, Ont.

Tenders will be received by the village clerk, Chas. E. Stewart, until noon August 4th, for the construction of cement walks, of about 6,000 lin. ft. or 24,000 sq. ft.

Edmonton, Alta.

The sum of $47,261 has been included in the city estimates for the construction of paving on 109th and 121st streets. Mr. A. J. Latornell is the engineer.

Fredericton, N.B.

The Provincial Government Department of Public Works has appointed Road Engineer, Jno. L. Feeney, Fredericton, to make a complete survey of roads, sewers, etc., in St. Mary's Parish and to report as soon as possible so that the department may make needed improvements.

L'Orignal, Ont.

Mr. Colin G. O'Brien, clerk to the village council, will receive tenders until 3 p.m. August 8th, for the construction of about 4,000 lin. ft. of concrete sidewalks.

Montreal, Que.

Tenders will be received by the Board of Commissioners until noon, August 11, for supplying, building and erecting at the low level pumping station, Montreal, a 24,000,000 imperial gallon, steam turbine driven high lift centrifugal pumping engine. Specifications are at the office of the Superintendent of Waterworks, City Hall.

Tenders will be received by the Board of Commissioners until noon, August 4, for the furnishing and erecting at low level pumping station of Montreal waterworks, two water tube boilers, as follows: 1 horizontal of 500 h.p., 1 vertical of 350 h.p., with all their fittings and appurtenances complete. Plans and specifications are at the office of the engineer, superintendent of waterworks, City Hall.

Montreal, Que. (Westmount)

Tenders will be received by the Municipal Council until noon, August 4th, for paving Oliver, Holton, Western, Metcalf and Lansdowne Aves., and St. Catherine Street. Plans are at the office of the engineer, Mr. P. E. Jarman.

Montreal, Que., Outremont

The purchase of a road-making equipment, including concrete mixer, steam drill and a tar kettle has been sanctioned by the town council.

New Toronto, Ont.

The council clerk, Mr. G. D. Scott, will receive tenders until August 3rd, for the erection of a pumping station in connection with the waterworks system. The engineers are Messrs. James, Louden & Hertzberg, 79 Adelaide St. E., Toronto.

Ottawa, Ont.

The city council has had plans drawn for the construction of asphalt pavement on Cambridge street between Primrose and Laurier streets. It is also proposed to lay wood block pavement on Augusta street, between St. Patrick and Henry streets, and on Thornton street, between Ralph and Bank streets.

The previous bids for the supply of 2 tarvia storage tanks have been rejected, and new tenders will be called shortly. The assistant engineer, Mr. F. C. Askwith, has the matter in hand.

Regina, Sask.

The question of the paving of Dewdney street will be submitted to the ratepayers on August 10th.

St. Catharines, Ont.

The Board of Works recommends the construction of concrete walks with combined concrete curbs on Clayburn Ave., Buckland Street, and 24 ft. permanent pavement on Albert street.

Sudbury, Ont.

The town engineer, Mr. R. H. Martindale, has plans in progress for the construction of about 70,000 sq. ft. of concrete sidewalks.

Toronto, Ont.

Tenders will be received by the board of control until August 4th for the construction of asphalt on nine streets, bitulithic on one street, asphaltic concrete on two streets, brick block on one street and concrete walks on 24 streets.

Toronto, Ont. (Newmarket)

The town council is considering the purchase of a site of 7½ acres for the laying out of a public park.

Toronto, Ont., Weston

Tenders will be received by the town clerk, Mr. J. H. Taylor, until August 4, for the construction of asphalt pavement on Main St., with concrete curb and gutter base. Plans are with the engineer, E. A. James, 57 Adelaide E., Toronto.

Hull, Que.

Tenders for the construction of sewers on Glenholme and Earnscliffe aves. and sidewalks on Barrie and Robina avenues and Holland Park, close on August 4th with Mr. F. Barber, engineer to York township, 57 Adelaide street east.

CONTRACTS AWARDED

Kingston, Ont.

Messrs. Foley & Gleeson, of Ottawa, have been awarded the contract for the construction of approximately 50,000 sq. yds. of sheet asphalt pavement on a concrete base.

La Salle, Que.

The town council has awarded to Messrs. Kennedy Brothers, of Montreal, a contract for the supply and laying of water mains and hydrants.

London, Ont.

The board of control has awarded to Messrs. Foley & Gleeson, of Ottawa, the contract for the construction of approximately 16,000 square yards of asphalt pavement on King street.

North Bay, Ont.

Mr. Geo. Thompson has secured the contract for the laying of about 8,000 lin. ft. of 5 ft. cement sidewalks.

The town council has awarded to Messrs. Sandrelli & Demarco, of Main St., the contract for the construction of 9,375 lin. ft. of sanitary sewers.

Ottawa, Ont.

The city council has awarded the following contracts for paving: Union Constr. Co., Bank St. Chmbrs., asphalt pavement, $79,110; Canada Creosoting Co., C. P. R. Bldg., Toronto, wood block pavements, $84,676.

Perth, Ont.

The town council has awarded to John Carroll, of Peterboro, Ont., the contract for the laying of about 30,000 sq. ft. of concrete walk.

Regina, Sask.

The city council has awarded the following contracts for the construction of pavements: National Paving Co., Ltd., Regina, 21,495 sq. yds. street pavement, $55,887; track pavement, 672 sq. yds., $2,217; Bitulithic and Contracting Co., Ltd., Regina, 22,293 sq. yds., $63,535.

The city council (waterworks dept.) has awarded to the Regina Foundry Co., Ltd., Regina, the contract for bending, welding, cutting and fabricating steel work for new 5,000,000 gal. reservoir.

St. Catharines, Ont.

The following contracts for sewers has been awarded by the city council: Upper & Lobb, 7 streets at $6,709; J. G. Mill, Oakville, Ont., 11 streets at $6,267; Thos. E. Riley, 1 street at $1,520.

Shaunavon, Sask.

The Prov. Govt. Board of Highway

Commrs. have awarded to T. B. Malloy, the contract for road construction.

Toronto, Ont.

The Board of Control has awarded the following contracts for the construction of sidewalks. W. E. Ransom, Dineen Bldg.; Queen City Concrete Paving Co., 179 Broadview Ave.; Ramsay Contracting Co., 39 Indian Rd. Cres.; Grant Contracting Co., 50 Front St. E.; Gardner & Co., 52 Strange Ave.; Riverdale Concrete Paving Co., 256 Jones Ave.; R. J. Moyes & Co., 592 Gerrard St. E.; Wm. Bushell, 158 Dundas St.; H. Mitchell, 464 Brock Ave.

The following contracts for sewer construction have been let by the Board of Control. J. H. McKnight Constr. Co., 88 St. David St., 3 streets, $1,922; Routly & Summers, 38 Benlamond Ave., 2 streets, $3,009; W. E. Taylor, 438 Clinton St., 1 street, $1,387; Godson Contracting Co., Manning Chmbrs., Moore Park Drainage System, $21,183; Connolly Agnew Co., 606 Avenue Rd., 3 streets, $4,840, and Lappin Ave., $28,350.

The York township authorities have awarded to the Lewis Contracting Co., the contract for the construction of sewers on Lauder avenue.

The following paving contracts have been transferred from the Commissioner of Works. Godson Contracting Co., Manning Chmbrs., asphalt on Webster and Grenville Sts., $7,695; Contracting & Paving Co., Confed. Life Bldg., Conduit and Tyrrel Sts., $21,547; Warren Paving Co., 103 Bay St., 9 streets, $42,847.

Walkerville, Ont.

The town council has awarded to Gouin & Desjardin, of Tecumseh, Ont., the contract for the construction of 400,000 s. yds. concrete walks at 9 and 11 cents per sq. yd.

Winnipeg, Man.

The Board of Control has awarded the contract for the supply of water pipe and hydrants to the Canada Iron Corporation, of Mark Fisher Bldg., Montreal. at $35.50 per ton. The total amount of the contract is $11,097.

Winnipeg, Man., Fort Garry

The Rural Municipality of Fort Garry has awarded the following contracts. L. B. Ritchie, Chambrs. of Commerce, Winnipeg, for the construction of all board sidewalks for which by-laws have been passed; R. Marcoux, 64 Provencher Ave., St. Boniface, $21,495, for 1½ miles of concrete paving on Pembina Highway.

Railroads, Bridges and Wharves

Brampton, Ont.

Tenders will be received by Mr. D. Kirkwood, clerk to the County of Peel, until August 1st for the construction of a 16-ft. span reinforced concrete bridge on the boundary line between the townships of Chinguacousy and Esquessing. Plans are with the engineer, Mr. C. R. Wheelock, Orangeville.

Bobcaygeon, Ont.

The Public Works Department has purchased a site for the new canal lock, and tenders are about to be called.

Chesley, Ont.

Tenders will be received by Messrs. Krug Bros. & Co. until August 1st, for the erection of a concrete dam on the Ankenmann property.

Fredericton, N.B.

The Public Works Department will have plans completed as soon as possible for the construction of a concrete wharf. The district engineer is Mr. J. K. Scammell.

Lunenburg County, N.S.

Tenders will be received by Mr. E. H. Armstrong, Public Works Department, Halifax, until noon August 7th, for the construction of a number of bridges and culverts.

Napanee, Ont.

Plans have been prepared by the Canadian Northern Railway for the erection of a station here.

Poole's Resort, Ont.

Plans for the construction of a granite sea wall, etc., are being prepared by Mr. A. Stuart Allister, architect, King St., Brockville.

Simcoe, Ont.

The Lake Erie & Northern Railway Company proposes erecting a bridge over River Lynn to cost $4,600 or donate that amount should the town decide to build a more substantial structure.

Sudbury, Ont.

The erection of timber bridges on Elgin and Pembroke streets is contemplated by the town council. The engineer is Mr. J. Richard Gill.

Toronto, Ont., Agincourt

The Scarboro Twp. Council has decided to erect a bridge on 3rd Concession, also to replace Jackson Bridge.

Vaughan Twp., Ont.

The work on the Wardlaw bridge will be done by day labor under the supervision of the engineer, Mr. F. Barber, 57 Adelaide street east, Toronto.

CONTRACTS AWARDED

Lamlash, Ont.

The following contracts have been awarded by the village council in connection with the erection of the bridge over Saugeen River. Steel, Hunter Bridge Co., of Kincardine, Ont.; concrete, Hugh Watt, of Chesley, Ont.

Toronto, Ont.

The contract for the construction of Strachan Avenue bridge has been awarded to Messrs. Wilson, Townsend & Saunders, of 79 Spadina Avenue. The figure is in the neighborhood of $35,000.

Walsingham Twp., Ont.

Richard Lyness, of Delhi, Ont., has secured the contract for the construction of the new cement bridge.

Public Buildings, Churches, Schools, etc.

Cobalt, Ont.

The erection of a new home for nurses is being considered by the hospital authorities.

Cabri, Sask.

The sum of $10,000 is about to be raised by the issue of debentures for the purpose of the erection of a fire hall and other improvements.

Campbellford, Ont.

Tenders for the erection of a drill hall will be received by the director of contracts at the Department of Militia & Defence, Ottawa, until noon, August 10, Plans and specifications are at the office of the officer commanding the 3rd Division, Kingston, Town Clerk, Campbellford, or the Director General of Engineer Services, headquarters, Ottawa.

Edmonton, Alta.

Funds are being raised for the purpose of erecting a tuberculosis hospital. Dr. Whitelaw, Rice street, is the secretary to the hospital board.

Guelph, Ont.

Plans are being prepared for the addition of a choir loft to the Dublin street Methodist Church. The estimated cost is $7,000, and tenders will be called in November.

Galt, Ont.

The Canadian Pacific and Grand Trunk railways are negotiating for the purchase of a station site on Main St.

Moncton, N.B.

Plans have been drawn for the erection of a market building on East Market street. The actual site will be determined by a plebiscite to be taken on August 9th.

Montreal, Que.

E. Payette, of 103 St. Francois Xavier St., has been appointed architect in connection with the erection of the public library on Sherbrooke St.

The R. C. School Commissioners are considering changing the site for the new girls' school to be erected at a cost of $200,000. Plans have been drawn by Messrs. Doucet & Morissette.

Montreal, Que., Lachine

Tenders for the erection of a fire station will be received by the architects, Messrs. Tetley & Dogart, of Montreal. The estimated cost is $15,000.

Montreal, Que., Maisonneuve

Tenders for the erection of a fire and police station, at a cost of $70,000, will be called shortly by the architect, Marius Dufresne, Ontario St., Maisonneuve.

Montreal, Que., Mile End

The Shamrock A. A. A. have under consideration the erection of a grand stand, at an estimated cost of $200,000. The architect will be decided upon shortly.

New Westminster, B.C.

Plans are being prepared by the building inspector for the erection of storehouse and stables on 8th Avenue.

Quebec, Que.

The plans for the erection of the new grand stand in the exposition grounds are not yet completed. Tenders will be called in September by the secretary, Mr. Geo. Morissette, City Hall.

It has been decided not to build a new church for the parish of St. Roch, St. Joseph street. It is probable that the present building will be repaired.

Regina, Sask.

The Episcopal Catholic Corporation are having plans drawn by Mr. J. E. Martin, for the erection of a brick and stone church, at an estimated cost of $30,000.

A site has been purchased for the erection of a new collegiate. Building operations will not be started this year. Mr. J. Kelso Hunter, 1818 Scarth St., is the secretary.

Richmond, Que.
Nothing further will be done until next spring in regard to the proposed addition of a tower to the Anglican church.

Simcoe, Ont.
The town council (Board of Education) has decided to erect a 5-room school in the south part of the town.

Shelburne, N.S.
The question of the erection of an alms house was brought up in the town council by Councillor Geo. Robertson.

Sydney, N.S.
Tenders for the erection of a fire hall in No. 5 Ward, will be received by the city clerk, Mr. J. J. Curry.

Toronto, Ont.
Tenders are in for the general contract for the erection of the Registry Office on Elizabeth street. 4 general and 50 separate trades were opened; the prices on the general contracts were $379,941, $380,884, $395,800, $363,421; submitted by Fred Holes & Son, Peter Lyall Construction Co., Norcross Bros. and John H. Parker-Canada Ltd., respectively. The tenders were referred to Property Commissioner Chisholm, the city architect and C. S. Cobb for report.

Wheatley, Ont.
The towncouncil are about to appoint an architect in connection with the proposed school additions.

Winnipeg, Man., Transcona
A by-law has been passed by the town council to cover the purchase of two additional school sites.

CONTRACTS AWARDED

Berlin, Ont.
The contract for the erection of the Y. W. C. A. building on Frederick St., has been awarded to Mr. Casper Braun, of 149 King street west.

Cobalt, Ont.
The contract for the erection of the public school has been secured by Mr. Judson Brown.

Churchbridge, Sask.
Messrs. James & Nichol, of Seaman, have secured the contract for the erection of the new school. The heating contract is not yet let.

Harley Twp., Ont.
The local school authorities have awarded the contract for the erection of the school building to Mr. Clement Ohlman, of Thwaites, Ont.

Innisfail, Ont.
The contract for the erection of St. Paul's Episcopal Church, near Allandale, has been awarded to Wm. D. Minnikin, of Allandale.

Napanee, Ont.
The Public Works Department has awarded the contract for the erection of the drill hall to Mr. A. S. Allaster, of King street, Brockville.

Ottawa, Ont.
The exhibition authorities have awarded the following contracts, for the erection of the entrance hall, Messrs. Thiviergc & Clanton, of Hull, Que.; for the erection of office and dressing rooms, the Architectural Sheet Metal Company, Vaughan street.

Sussex, N.B.
The Provincial Government Department of Agriculture has awarded to Walter F. Lutes, the contract for the erection of the agricultural college.

Stratford, Ont.
The general contract for the erection of the agricultural buildings has been awarded to Mr. Chas Keller. Messrs. Kalbfleisch Brothers have the contract for lumber.

The contract for terrazzo floors, etc., in connection with the additions to the Avon Ward school has been awarded to Italian Mosaic & Marble Co., of Euclid and College street, Toronto.

Toronto, Ont.
The following contracts have been awarded in connection with the erection of the new technical school on Lippincott St.: Refrigeration, Keiths, Ltd., Campbell Ave., $6,000; filtration, F. Armstrong Co., 277 Queen St. W., $3,800; plumbing, F. Armstrong Co., 277 Queen St. W., $20,678; electrical and gas, A. R. Rice Co., 152 Bay St., $8,700.

Unity, Sask.
The school contract has been awarded by the Round Valley School District No. 2321, to Mr. H. E. Hopkins, of Scott, Sask.

Vancouver, B.C.
Messrs. Whiteside & Williamson, of 2303 Main street, have been awarded the contract for the erection of postal station "C," at Mount Pleasant.

Yorkton, Sask.
The local contracting firm of Logan & Black has secured the contract for additions to the Land Titles Office.

Business Buildings and Industrial Plants

Calgary, Alta.
The Western Canada Flour Mills Ltd., of Winnipeg, will build a power house and increase the capacity of the present mill. Engineers, Theo. Kipp Co., Ltd., Union Trust Co., Winnipeg.

Edmonton, Alta.
It is understood that the business block projected by Mr. E. F. Hutchings, will not be built this year.

A pottery plant will be built by the recently organized Pioneer Fire Clay Company, who will manufacture sewer pipes, face bricks and earthenware.

The Swift Canadian Co. propose to add 3 storeys to their packing warehouse. The matter has not been definitely decided as yet, but plans are under consideration.

North Edmonton, Alta.
The Great Northern Tannery Company proposes to erect a 3-storey builders will be invited immediately.

Ford City, Ont.
The Ford Motor Company have plans in progress for certain additions to their factory.

Fort William, Ont.
Messrs. W. H. Dwyer & Co. have under consideration the construction of an elevator on No. 2 Island.

Hamilton, Ont.
The Canadian Express Co. will probably erect stabling premises on Strachan street.

Jacquet River, N.B.
The Louison Lumber Co. will rebuild at once. The equipment required will include a band mill of similar capacity to the former mill which was destroyed by fire.

Lambton, Ont.
Mr. Peter Downing, of the Lambton House, will make certain additions and alterations to his premises.

London, Ont.
The A. A. Langford Company, of 425 Richmond street, will not build the proposed factory this year.

Montreal, Que.
Tenders for certain alterations to the premises of the Garth Company, 28 Craig Street West, will be received by the architect, Mr. H. C. Stone, 84 St. Francis Xavier Street.

The proprietors of Waltons Lunch Room, 259 St. James St., propose to erect new premises.

Montreal, Que., Westmount
Plans have been drawn for the construction of an artificial ice plant for the Montreal Arena Company. The architect is Mr. R. E. Bostrom, McGill Building, who invites tenders for general contractor.

Ottawa, Ont.
J. & C. Low, contractors, 262 Catherine street, will rebuild their planing mill, but have not yet decided upon the site.

Penticton, B.C.
Mr. Jas. J. Warren, president of the Kettle Valley Railway, proposes to erect a fruit warehouse, at an estimated cost of $25,000.

Regina, Sask.
Plans for the erection of a business block for the Episcopal Catholic Corporation are being drawn by Mr. J. E. Fortin, of 210 Kerr Block.

St. George, N.B.
Mr. G. E. Fairweather, of 84 Germain St., St. John, is preparing plans for the erection of a branch office of the Bank of Nova Scotia.

Toronto, Ont.
Mr. J. M. Warren, of 30 Vaughan Rd., has purchased a site of 5 acres for the manufacture of cement bricks.

Vancouver, B.C.
N. A. Leech, architect, 615 Pender St. W., is now receiving tenders on the erection of a $12,000 factory.

Walkerville, Ont.
The erection of a theatre is proposed by the Garden Theatre Co., Ltd., of Ontario, 69 Sandwich St. Mr. G. How-

(Continued on page 76)

Tenders and For Sale Department

Concrete Sidewalks

Tenders addressed to Village Clerk, Bobcaygeon, Ont., will be received till noon, August 4th, for the construction of Cement Sidewalks, about 6,000 lineal feet, or 24,000 square feet, more or less. Lowest or any tender not necessarily accepted.

29-30

TOWN OF CANORA

Province of Saskatchewan

Sealed tenders will be received by the undersigned, Secretary-Treasurer of the Town of Canora, until Tuesday evening, 8 o'clock p.m., August **18th, 1914**, for the following works:—

Contract A—Laying Cast Iron Water Mains.

Contract B—Construction of Pump House.

Contract C—

1. Construction of Steel Water Tower.
2. Construction of Concrete Foundation.

Contract D.—Furnishing of Cost Iron Pipe and
3. Housing of Water Tower.
Specials.

Contract E—Furnishing Fire Hydrants and Valves.

Contract G—Furnishing and Erecting Pumping Machinery.

Plans and Specifications may be seen at the offices of the Engineers, Toronto and Winnipeg, or at the Town Hall, Canora, Sask., on and after July 24th, 1914.

The lowest or any tender not necessarily accepted.

S. KORBIN, Mayor.
H. M. SUTHERLAND, Sec.-Treas.
CHIPMAN & POWER, Engineers,
Toronto and Winnipeg.

29-30

Sealed tenders addressed to the undersigned, and endorsed "Tender for Drill Hall, Ingersoll, Ont.," will be received at this office until 4 p.m. on **Thursday, August 6, 1914**, for the construction of the aforesaid building.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., on application to the Caretaker, of the Post Office, Ingersoll, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, July 14, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—64377.

29-30

TENDERS

Township of Bertie Street or Road

Sealed tenders addressed to the undersigned and marked "Tender for Street" will be received until 2 p.m. on **Friday, July 31, 1914**, for the construction of about one and one-half miles of street or road known as the "Erie Road Extension," to be constructed of water-bound macadam, concrete, rocmac, or tarvia, etc. Plans and specifications, etc., may be seen at the clerk's office, Ridgeway. A marked cheque for 5 per cent. of the amount of the tender must accompany each tender.

The lowest or any tender not necessarily accepted.

M. S. POUND, Clerk.

Dated July 15th, 1914. 29-30

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, August 4th, 1914**, for the construction of the following sewers, viz.:—

Alton Ave., Doel Ave. to 71 ft. north of Stanton Ave.
Cumberland St., Avenue Road to Bellefair St.
Ethel Cres., C. L. Rosehill Ave. to west limit Lot No. 1, Plan 920-K.
Fairford Ave., Morley Ave. to Hiawatha Ave.
Garrison Creek Storm Overflow Sewer, Section No. 4, from 120 ft. south Harrison St. on Roxton Road to south limit Bickford Park, via Roxton Road, Lots 8, 9, 10, 13, 14 and 15, Plan 302, Shaw St., Sully Cres., Montrose Ave., College St. and Beatrice St.
Glendonwynne Road, Glenholme Drive to Goldengate Ave.
Glenmanor Drive East, north side Pine Cres., to Williamson Road.
Heath Street, East limit Lot 71, Plan 895 to E. S. Spring Street.
Lane first north of Amelia St., Sackville Street to west end.
Lane first north of Amelia St., Sumach St. to west end.
Lane first east Broadview Ave., Gerrard Street to south end, thence east to Bolton Ave.
Lane first west Claremont St., north side of Crocker Street to south side of Plymouth Pl.
Lane first south of Gerrard Street. west side of Sherbourne St. to east side of George Street.
Lane first west of Roncesvalles Ave., Garden Ave. to north end, thence west to west end.
Lane first west Sherbourne St., Duchess St. to Queen Street.
Lane first east Sumach St., Gerrard St. to Spruce Street.
Mavety Street, Hillsview Ave. to Humberside Avenue.
Park Avenue, Beech Avenue to east end.
Scollard Street, Yonge Street to Hazelton Ave.
West Toronto Sewer System. Division No. 2, Storm Outlet Section No. 2, through High Park.
Wheeler Avenue. 1410 ft. north of north side Queen St. to 310 ft. further north.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer. not members of the City Council or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company, approved as aforesaid.

The usual conditions relating to tendering as prescribed by City by-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, July 16th, 1914. 30

TOWN OF DUNNVILLE

Concrete Pavement

Sealed tenders will be received by the undersigned up to 8 p.m. on **Saturday, August 1st, 1914**, for the construction of approximately:—

7,800 sq. yds. of concrete pavement on Broad Street West.
1,900 lin. yds. of Concrete Curbing on Broad Street West.
6,600 sq. yds. of Concrete Pavement on Broad Street East.
1,500 lin. yds. of Concrete Curbing on Broad Street East.
6,400 sq. yds. of Concrete Pavement on Cedar St.
1,500 lin. yds. of Concrete Curbing on Cedar St.

Plans and specifications and forms of tender may be seen at the office of the Town Engineer, Dunnville.

ROBERT G. KYD,
Town Engineer,

Dunnville, Ont., July 21, 1914. 30

Tenders for the Construction of a Bridge on the Don Section of the Bloor St. Viaduct

Tenders will be received, by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Monday, October 5th, 1914**, for constructing across the Don Valley a bridge consisting of five steel arch spans, with piers and approaches; the width being eighty-six feet, and the length, approximately sixteen hundred and eighteen feet. Bidders may obtain specifications, including plans and form of tender, on application to the Commissioner of Works, Toronto, after paying to the Commissioner of Works twenty-five dollars for each set, this sum to be refunded upon return of plans. The Engineer's Estimate of Quantities will also be sent on request. Specifications, including plans, may be seen at the offices of the Commissioner of Works, Toronto; the Commercial Intelligence Department of the Board of Trade, London, England; the Engineering News, New York; Engineering and Contracting, Chicago; and Engineering, London, England.

Those desiring to submit tenders on reinforced concrete construction for the above bridge, are hereby notified that they may prepare and submit, without any expense whatsoever to the City, their own plans and specifications, based on the loading given in the specifications for steel construction, and may tender on the same. These tenders will be received up to noon on Monday, October 5th, 1914.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering, as prescribed by City By-laws must be strictly complied with, or tenders may be declared informal.

A deposit in cash, or a marked cheque, equivalent to 2½ per cent. of the amount of the tender, payable to the order of the City Treasurer, must accompany each tender, which deposit will be retained until provisions of by-law 4294 are complied with.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto, July 21st, 1914. 30-33

Greater Winnipeg Water District

Tenders for Aqueduct Construction

Sealed tenders addressed to the undersigned will be received up to noon of Saturday, 19th September, 1914, for the construction of Eighty-five miles of concrete aqueduct in five sections of approximately equal length.

Plans, specifications and form of tender can be secured after July 20th, 1914, by application to the District accompanied by certified cheque for One Hundred Dollars payable to the District, which deposit will be returned upon submission of tender or return of documents.

Bidders may tender on any section or on any number of sections.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,
Chairman of Commissioners
901 Boyd Building,
Winnipeg, Man., July 6, 1914. 30-36

CITY OF LONDON

Tenders for Steam Boilers

Sealed proposals addressed to the Chairman and Members, Board of Control, will be received at the office of the City Clerk up to 9 a.m. on Friday, the 7th day of August, for the furnishing of Steam Boilers at the Incinerator in conjunction with the Heating of Victoria Hospital.

Separate tenders will be received for setting the boilers.

Copies of specifications may be seen in the City Engineer's office, and all further particulars secured, on application to H. P. Elliott, Consulting Engineer, 484 Ridout Street, London, also of Toronto.

Tenders to be accompanied by a deposit cheque, duly certified, for 5 per cent. of the amount of contract.

The lowest or any tender not necessarily accepted.

C. M. R. GRAHAM, Mayor.
W. N. ASHPLANT, City Engineer. 30

Corporation of the City of Westmount

Tenders will be received for the paving of Olivier Avenue, Holton Avenue, Western Ave., St. Catherine Street, Metcalfe Avenue, Lansdowne Avenue.

Plans and specifications may be obtained at the office of the City Engineer upon deposit of $5.00, which deposit will be returned upon receiving bona fide tender and return of the plans and specifications.

Tenders must be sent to the Secretary-Treasurer sealed and plainly marked "Tenders for Paving," not later than 12 noon, August 4th, 1914.

The Council does not bind itself to accept the lowest or any tender.

Signed, P. S. JARMAN,
30 Acting City Engineer.

Municipalities and others sending in tender advertisements for the Contract Record are requested to bear in mind that these must be in our hands by

Ten o'clock on Tuesday morning,

each week, in order to be published in the issue of the following day.

JUDICIAL SALE

of the Assets of

The Canadian Mineral Rubber Co.

LIMITED

In the matter of the Winding-Up Act, being Chapter 144 of the Revised Statutes of Canada and Amending Acts, and in the matter of the Canadian Mineral Rubber Company, Limited.

Sealed tenders will be received addressed to "George O. Alcorn, Esq., Master-in-Ordinary, Osgoode Hall, Toronto, Canada," and marked "Tenders in the matter of The Canadian Mineral Rubber Company, Limited," up to 2.30 p.m. of Friday, the 18th day of September, 1914, for the purchase of certain assets of the said Company consisting of:—

PARCEL No. 1—Located at Model City, adjoining Montreal, and at Sorel, Que.

Cummer asphalt paving plant, railroad type, and sundry accessories including rollers, concrete mixers, tank cars, tools, etc., etc.

PARCEL No. 2—Located at Winnipeg, Manitoba.

Roofing and flooring material and equipment, paint, pipe-coating, office furniture, safe, etc., etc.

PARCEL No. 3—Located at Calgary, Alberta.

Merriman asphalt paving plant, railroad type, and sundry accessories, including roller, stone crusher, concrete mixers, hoisting engine, tools, asphalt, cobbles, office furniture, etc., etc., together with a certain lease of dredging rights for sand and gravel, the liabilities under which must be assumed by the purchaser.

PARCEL No. 4—Located at Vancouver, British Columbia.

Cummer asphalt paving plant, railroad type, and sundry accessories, including rollers, stone crusher, concrete mixers, hoisting engine, tools, asphalt, rock, office furniture, motor-cycle, etc., etc.

PARCEL No. 5—Located at New Westminster, British Columbia.

Merriman asphalt paving plant, railroad type, and sundry accessories, tools, etc., etc.

PARCEL No. 6—Located at Victoria, British Columbia.

Merriman asphalt paving plant, railroad type, and sundry accessories, including rollers, concrete mixers, graders, automobiles, tools, supplies, office furniture, etc., etc.

PARCEL No. 7—Located in the State of Utah, U.S.A.

Certain claims and mining rights covering a deposit of practically pure bitumen (gilsonite) and bituminous limestone.

Possession. Immediate possession of parcels Nos. 1, 2, 3, 4, 5, and 7 can be given on completion of sale. Possession of parcel No. 6 cannot be given until certain paving at the City of Victoria, B.C., in which the Liquidator is at present engaged, is completed. If, before the completion of the sale, the purchaser requires possession of any parcel, of which possession can be given by the Liquidator, he may obtain same by giving security for the unmatured payments satisfactory to the Master-in-Ordinary of the Supreme Court of Ontario. Tenders must be made on the understanding that inability on the part of the Liquidator to deliver possession of, or transfer the title to any item shall operate as a cancellation of the sale in respect of such item only, and shall not operate as a cancellation of the sale as a whole. The amount of any allowance to be made in respect of any such item shall be determined by the Master-in-Ordinary of the Supreme Court of Ontario.

Tenders will be received for all parcels en bloc and for each parcel separately.

All rentals, taxes, insurance, water rates, and similar items will be adjusted to the date of the acceptance of the tender.

Full information as to all parcels with inventories of parcels Nos. 1, 2, 3, 4, 5 and 6, and a echedule of the claims and mining rights included in parcel No. 7, and copies of the Lease referred to in Parcel No. 3, may be obtained from the Liquidator,

NATIONAL TRUST COMPANY, LIMITED, TORONTO, CANADA.

Terms of Payment. Ten per cent. of the amount tendered shall accompany each tender, 15 per cent. on the acceptance of the tender, and the remainder in 3 equal instalments at 3, 6 and 9 months without interest. On receipt by the Liquidator of the final payment, the sale shall be completed. All tenders must be accompanied by an accepted cheque payable to the Liquidator for 10 per cent. of the amount of the whole tender, which cheque will be returned if the tender is not accepted, and forfeited if the tender is accepted, and purcahse not completed by the tenderer.

The highest or any tender not necessarily accepted.

The purchaser shall, at his own expense, make whatever search of title he may deem necessary or expedient, and the Liquidator shall not be required to furnish any abstracts or produce any deeds, declarations, or other evidence of title except those in its possession. The purchaser shall have 15 days from the date of acceptance of tender within which to make any objections or requisitions in respect of the title and in case the purchasershall, within such time make any objection or requisition which the Liquidator shall from any cause, be unable or unwilling to remove or answer, then the Liquidator may (notwithstanding any intermediate negotiations) rescind the sale, in which case the purchaser shall be entitled only to a return of the deposit money without interest, costs or compensation.

The other conditions will be the standing conditions of sale of the Supreme Court of Ontario as far as applicable.

Tenders will be opened at the office of the Master-in-Ordinary, Osgoode Hall, Toronto, Can., at 2.30 p.m., on the 18th day of September, 1914, when all tenderers are requested to be present.

Dated at Toronto, this 10th day of July, 1914.

NATIONAL TRUST COMPANY, LIMITED,
Toronto, Ontario, Canada,
30-31-33-35 Liquidator.

Tenders Wanted

Tenders wanted on all trades for residence on Melgund Road and Lyndhurst. Tenders close August 11th. S. B. Coon & Son, Architects, 409 Ryrie Building, Toronto. 30

Tenders for Concrete Sidewalks

Sealed tenders, marked "Tenders for Sidewalks," will be received by the undersigned up to three o'clock p.m. of Saturday, **the Eighth day of August, A.D. 1914**, for the construction of about four thousand lineal feet of concrete sidewalks in the Village of L'Orignal.

Plans and specifications may be seen at the office of the undersigned at L'Orignal, Ontario.

Every tender must be accompanied with an accepted cheque for $200, which will be forfeited in case the tenderer fails to enter into a proper contract (with sureties if required) within ten days after being notified of the acceptance of his tender. Where tender is not accepted, cheque will be returned as soon as contract is awarded.

The lowest or any tender not necessarily accepted.

Dated at L'Orignal this 20th day of July, A.D. **1914.**

COLIN G. O'Brian,
Village Clerk.

29-30-31

TOWN OF THOROLD

Province of Ontario

Pavements

Sealed tenders will be received by the Town Clerk until 8 p.m. on Wednesday, **August 5th, 1914**, for constructing permanent pavements in the Town of Thorold on—

(1) Carleton Street.
(2) Portland Street.

Plans, specifications, etc., may be seen at the Town Hall, Thorold, or at the Engineer's offices, Mail Building, Toronto.

The lowest or any tender not necessarily accepted.

JOSEPH BATTLE, Esq., Mayor.
D. J. C. MUNROE, Esq., Town Clerk.
CHIPMAN & POWER, Engineers. 30

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board will be received up to **Friday, August 28th**, for the erection of a High School of Commerce.

Tenders will be received up to Tuesday, August 11th for the erection of Leslie Street School (north of Danforth) and Forrest School. Also for putting up a building in the rear of Winchester Street School for manual training and domestic science.

The following miscellaneous tenders will also be received up to August 11th:—Plumbing, Withrow Avenue; Heat Regulation, Withrow Avenue; Cabinet Work, Malvern High School; Electric Wiring, Sundry Schools; Plumbing, sundry schools. Local Telephones, sundry schools.

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, not later than 12 o'clock noon on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted. All tenders must be on revised forms.

W. C. WILKINSON,
Secretary-Treasurer.
W. W. Hodgson,
Acting Chairman of Committee.
30

Equipment Wanted

Wanted, at once, second hand roofer's pitch kettle on wheels. Kindly give particulars as to condition, stating price and where it can be seen, to Box 59, Contract Record, Toronto. 30

Machinery and Materials

Sealed tenders, registered and endorsed on the envelope, tender for (tender bidden on) and addressed to H. H. Elliott, M.D., Secretary-Treasurer of the Town of The Pas, will be received up to 6 p.m., **August 11, 1914**, for the supply and delivery of the following machinery and materials.

Tender "A"—For the supply and delivery of two Sewage Lift Pumps.

Tender "B"—For the supply and delivery of Electric House Meters.

Tender "C"—For the construction of Sewage Lift Chamber and Oil Tank Chamber.

A marked cheque for five per cent. (5 p.c.) of the amount of the tender must accompany each bid. The lowest or any tender not necessarily accepted.

Plans and specifications may be seen at the offices of the Consulting Engineers, Saskatoon, Sask.; the Resident Engineer, The Pas, Man.; Contract Record, Toronto, Winnipeg and Montreal, or a complete set of plans and specifications will be given or forwarded on deposit of $25 and a set covering all contracts on a deposit of $50, which deposit will be returned on receipt of a bonified tender and return of specifications. Specifications on House Meters to be obtained from the Saskatoon Office, only, without charge.

H. H. ELLIOTT, Secretary-Treasurer,
The Pas, Man.

MURPHY & UNDERWOOD,
Consulting Engineers,
Saskatoon, Sask.

28-29-30-31

ENGINEERING DRAUGHTSMAN for Toronto, with at least three years' experience in sewer design; initial salary, $21.00 to $24.00 per week, according to qualifications. Send full particulars to Mr. Worthington, Sewer Section, Works Department, City Hall, Toronto. 30

WANTED—Second hand concrete mixer; also hoist; must be in good working order. Would also consider purchase of general concrete construction equipment. Answer, giving all possible particulars and closest price for cash, to Box 66, Contract Record, Toronto. 30

Positions Wanted

Architectural draughtsman (Scotsman), 12 years American and Canadian experience, seeks engagement. Good man on working drawings and detail. First class references. Box 54, Contract Record, Toronto. 29-30

To Civil Engineers and Contractors.—Technical graduate, age 28, single, experienced in railroad and general construction. First class draughtsman and instrument man, desires position. Apply Engineer, care Contract Record, 119 Board of Trade Bldg., Montreal. 29-30-31-32

CONTRACTORS—Advertiser wants position as blacksmith. Is also expert with steam or gasoline engines and general plant repairs. Now employed but wishes change to more active work. Apply Box 51, 119 Board of Trade Bldg., Montreal. 29-30

Business Buildings and Industrial Plants

Continued from page 73

ard Crane, Ford Bldg., Detroit, Mich., is the architect.

Windsor ,Ont.
The Horlick Malted Milk Co., of Racine, Wis., U.S.A., has purchased a 20-acre site for the erection of a factory. building operations may begin in six months' time.

Messrs. Leybourne & Whitney, the local architects, have drawn plans for the erection of stores on Wyandotte street for the Mechanics' Building Company.

Winnipeg, Man.
The Breen Motor Company propose to make extensive additions to their premises on Broadway and Sherbrooke street. Mr. J. N. Semmens is the architect.

CONTRACTS AWARDED

Berlin, Ont.
The contract for masonry on the additions to the factory of the Berlin Racycle & Mfg. Co., Ltd., 61 Frederick St., has been awarded to Mr. Casper Braun, of 149 King St. W.

Hamilton, Ont.
The Hamilton Bridge Works have secured the contract for the steel work in connection with the extensions to the plant of the National Steel Car Company.

Montreal, Que.
Mr. F. N. Hartman, of the Guy Block, has secured the contract for the erection of Mr. Jas. Strachan's stables on City Hall Avenue.

The contract for alterations and additions to Mr. Jas. M. Aird's bakery on St. Urbain street, has been awarded to Messrs. D. G. Loomis & Sons, of 1112 St. Patrick street.

Messrs. A. F. Byers & Co., Ltd., of 340 University street, have secured the contract for the construction of the boiler house for Messrs. R. Macfarlane & Company.

The Hamilton Brass Company, of 327 West Craig Street, have been awarded the contract for the alterations to Kastel's Hotel, St. Catharine St. West.

Regina, Sask.
Mr. Milne has awarded the contract for the erection of the new "Empress" theatre to Mr. T. R. Davidson, of 2125 McIntyre street.

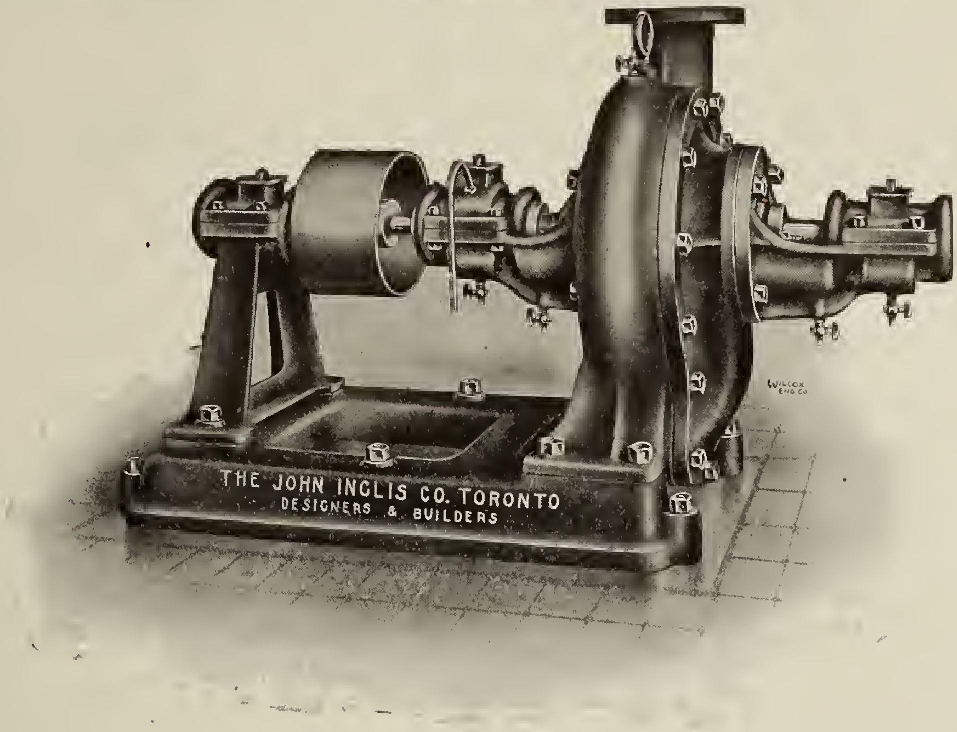
Toronto, Ont.
The contract for the erection of Mr. C. W. Watson's bakery on Pendrith avenue, has been let to J. Kirby, 107 Ossington Ave.

The contract for the erection of the Catholic Episcopal Corporation office building has been let to Messrs. Fred Holmes & Son, of 1113 Yonge Street.

The contracts for the erection of a store and apartment house on Yonge street, opposite Summerhill Ave., has been awarded as follows: Masonry, Chalkley & Son, 34 Victoria street; carpentry, P. J. Corcoran, 306 St. Clarens Avenue.

Windsor, N.S.
J. H. Hicks & Sons, of Bridgetown, are the general contractors for the erection of the new warehouse for Curry's Fruit Company.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Residences

East Angus, Que.

Mr. O. Drapeau is considering the erection of a brick tenement house on Maple avenue.

Hamilton, Ont.

New tenders on the erection of a residence on Delaware Ave., for Mr. R. H. New, will be received by the architects, Messrs. McPhie, Kelly & Darling, until August 5th.

Montreal, Que.

Plans for the erection of a residence on St. Andre St., have been drawn for the R. C. School Commissioners, by Doucet & Morissette, New Dandurand Bldg. The Commissioners are considering changing site.

Recent building permits include the following: A. DeLadurantaye & Freres, 270 DeLevcs St., flats on Clifton Ave., to cost $5,000; H. Dubois, 1550 Chabot St., flats on Bordeaux St., to cost $6,500; J. U. Cartier, 442 Mance St., flats on Mance St., to cost $10,000; J. Levesque, 1579 Hutchinson St., residence on Prudhomme Ave., to cost $10,000.

A permit has been issued to J. E. Robin, of 589 9th Ave., for the erection of flats on 10th Ave., at a cost of $12,000.

Montreal, Que., Longueuil

Tenders for the erection of a $15,000 residence for Mrs. E. B. Carmichael, Longueuil, are invited by the architect, W. J. Carmichael, Bell Telephone Co., Montreal.

Montreal, Que., St. Laurent

Plans for the erection of a residence for H. E. Trudeau, have been drawn by G. A. Monette, 706-83 Craig St. W., Montreal. No contracts have been awarded yet.

Montreal, Que., Westmount

Separate tenders on the erection of two residences are invited by Mr. Frank Munro, 4910 Sherbrooke Street West. The estimated cost is $15,000.

Tenders for alterations to the residence of Mr. R. A. Webster, will be received by the architect, Mr. J. H. McDowell, Drummond Bldg.

The Downing Cooke Company has been successful in obtaining the contract for the erection of Mr. J. Blumenthal's new residence on Redfern Avenue.

It is understood that the residence on Montrose Ave. proposed by Mr. J. Irwin, will not be built this year.

Ottawa, Ont.

J. H. Copping, of 65 James street, proposes to make alterations to his residence on Daly Ave., at a cost of $7,000.

The Oakland Land Co., 157 Sunnyside proposes to erect a residence on Bellwood Street, at an estimated cost of $6,000.

The erection of a residence on Pamilla street is proposed by Mr. M. Crate.

Mr. A. F. McFarlane, of 76 Arlington St., proposes to erect a $5,000 residence on Allan street.

The erection of a residence on Fentiman street, at a cost of $6,000, is contemplated by Mr. B. A. Grison, 100 Fentiman street.

Regina, Sask.

Storey & Van Egmond, of McCallum Hill Bldg., are drawing plans for the erection of an apartment block on Albert street at a cost of $25,000.

Sherbrooke, Que.

Mr. C. P. Byrd is drawing plans for the erection of a residence for Mr. J. Nicol, 95 Wellington street. The estimated cost is $5,000.

Streetsville, Ont.

Mr. J. S. Valleau, of 187 St. Clarens Ave., Toronto, has purchased 88 acre farm on Credit River, and proposes to erect a summer residence.

Toronto, Ont.

P. H. Love, of 2369 Yonge St., is having plans drawn for the erection of a $5,000 residence on Lytton Boulevard.

Mr. W. J. Kendle, of 764 Gerrard E., has had plans drawn for the erection of a detached residence on Fairview Boulevard.

Mr. Davis, 434 College St., is inviting tenders for the erection of 2 residences on Kennedy Avenue.

Winnipeg, Man.

Messrs. Olson & Olund, of 159 Harbison St., Elmwood, contemplate building a number of residences in the near future.

Mr. L. Knirck, of 560 Mountain Ave., has under consideration the erection of a number of residences.

The erection of a number of residences is contemplated by J. Popel, 783 Aberdeen street.

Winnipeg, Man., St. James

Messrs. Cockerell & Page propose to erect a residence on Berry St., at an estimated cost of $5,500.

CONTRACTS AWARDED

Montreal, Que.

The contract for the erection of Mr. J. Clark's residence, on St. Catherine St., has been awarded to A. Kelly, 1955 St. Urbain street.

Ottawa, Ont.

Messrs. Johnstone & McCarthy, 84 4th Ave., have secured the contract for the erection of a residence on 1st Avenue for Mr. U. Norrish.

Regina, Sask.

The contract for the erection of a residence for Mr. F. Chenoworth, Stinton Block, has been awarded to A. E. Downes, Simpkins Block.

St. Anne de Bellevieu, Que.

S. W. Hamilton, of Coristine Bldg., Montreal, has been awarded the contract for the erection of a residence for Mr. J. Murray Gibson.

Victoria, B.C.

A contract has been secured by the Drysdale Construction Company for the erection of a residence on Beech Ave., for Mr. C. D. Finlayson.

Power Plants, Electricity and Telephones

Bolton, Ont.

The ratepayers will be asked to vote on August 3rd on the question of installing hydro-electric power. The council has purchased the plant of the local power and plant company.

Cornwall, Ont.

The Conservation Commission has directed the chief engineer to make a survey and profile of the St. Regis River, from its head waters to its mouth at the St. Lawrence River. He was also ordered to make preliminary plans of dams and possible water storage basins with estimates of the cost thereof, together with a description of existing power developments and venues thereof.

Cupar, Sask.

The Dalrymple Rural Telephone Co., Ltd., is inviting tenders for the furnishing of material and construction of a telephone system. Plans, etc., are at the office of the Dept. of Telephones, Regina. Tenders close with the secretary, Mr. J. Donald, Cupar, on August 7th.

Dresden, Ont.

The ratepayers passed the hydro-electric by-law on July 21st by a overwhelming majority.

Estevan, Sask.

The local firm of H. E. McKenzie Company has been awarded the contract for the installation of the telephone exchange on Block No. 19.

Guelph, Ont.

The Bell Telephone Company proposes to erect an exchange building on Cork street, and tenders are invited by the architect, Mr. W. J. Carmichael.

Montreal, Que., Outremont

The town council is about to call tenders for 3,600 feet of 3-strand cable.

Regina, Sask.

The Hospital Board are inviting tenders for the installation of an electric lighting system for the new wing of the general hospital. Mr. N. R. Darrach is the architect.

Shawinigan Falls, Que.

The Belgo Can. Pulp & Paper Co., Ltd., have had plans drawn for the installation of engines and turbines.

CONTRACTS AWARDED

Lacombe, Alta.

The town council has awarded a contract to the Waterous Engine Works Co., of Brantford, Ont., for a Ret tubular boiler for the Electric Light Dept.

Regina, Sask.

The sub-contract for plumbing and drain work in connection with the new power house has been awarded to Messrs. Wilson & Wilson, of Westmann Chambers.

The city council light and power department have awarded the contract for street lighting, equipment and switchboard for the new power house as follows: Canadian Westinghouse Co., $32,000; Canadian General Electric Co., $8,570; Northern Electric Co., $268; Maloney Electrical Co., $594; Siemens Co. of Canada $7,850; Burnham Engineering Co., $2,600.

Winnipeg, Man.

The Modern Construction Company,

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Interlocking Hollow Tile

The Modern Building Material

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Moisture Proof
Vermin Proof

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Warm in Winter
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Lays up rapidly
Little Mortar required

¶ Makes a Strong Wall
A Light Wall
A Hollow Wall

Write us for full data.

The One Price Company

Sun Brick Company, Limited

Traders Bank Building

816 Sterling Bank Building, has been awarded the contract for the construction of additions to the Annabella street power house.

Miscellaneous

Dutton, Ont.
The ratepayers will vote on by-law July 31st, for the distribution and sale of natural gas.

Hamilton, Ont.
The council passed a by-law on July 14th to purchase the quarry. The question will be submitted to the ratepayers August 12th. $45,000 for purchase; $30,000 for equipment.

Moosomin, Sask.
R. A. McLoughry, secretary to the Fitzsimons Gas Co., Ltd., Moosomin, will receive tenders until August 1st for drilling and casing a test gas well on Sec. 14, Twp. 12, Range 30 West 1, 2,000 ft. deep if necessary. Tenderers are to state price per ft. for work complete.

Ottawa, Ont.
J. H. Button, Room 18, 71½ Sparks St., requires prices for the supply of 300 yds. gravel or crushed stone f.o.b. cars South Indian.

Pembroke, Ont.
Prices and information are invited by Mr. James Sarsfield, for 800-gallon fire engine, steam or gasoline.

Regina, Sask.
F. McArthur, City Engineer, will be glad to receive catalogues and all information regarding sewer trenching machines as soon as possible.

Rigaud, Que.
Plans for the construction of a stone crusher plant have been drawn for the Rigaud Granite Company, by Poullin & Poirier, 62 Broadway, New York. Tenders will be received shortly for cars, electric motors and general machinery, also for building. The total cost of the project is estimated at $100,000.

Smithville, Ont.
J. R. Goring & Son require plans and estimates for hot water heating system.

St. Thomas, Ont.
The city council has authorized the expenditure of $20,000 on repairs and improvements to the gas plant.

Toronto, Ont.
Tenders will be received by the Mayor until noon August 11th, for the supply of motor-driven fire apparatus, fire hose and rubber covered tarpaulins. Specifications are at the office of the Fire Department, 152 Adelaide St. W.

Tenders will be received by the Mayor until noon, August 18th, for the installation of a coal and ash handling apparatus at the main pumping station. Specifications, etc., are at room 12, Purchasing and Accounting Sec., Department of Works, City Hall.

Business Notes

Brockville, Ont.
The premises of the Cossitt Mfg. Co. have suffered damage by fire. The loss on the building is $5,000, which is covered by insurance. The company will probably rebuild.

Deer River, Ont.
The plant of the Trenton Cooperage Mills, Ltd., has been destroyed by fire. The loss of $12,000 is partly covered by insurance.

Hull, Que.
The machinery and plant of the Canade Cement Company has been badly damaged by fire. A loss of $25,000 is reported.

Nanaimo, B.C.
The lumber mill of the New Ladysmith Lumber Company has been completely destroyed. The loss of $30,000 is fully covered by insurance.

Ottawa, Ont.
The Watson Carriage Company's plant was recently burnt out. The loss is fully covered.

Prince Albert, Sask.
The McKay & Adams Block has been destroyed by fire, and a loss of about $80,000 inflicted.

Sudbury, Ont.
The garage and livery of Mr. I. Proctor has been destroyed. The loss is placed at $10,000.

Valcartier, Que.
Alfred Lepire's sawmill was recently destroyed by fire.

New Companies

Interior Construction Company, Limited, has been incorporated with a capital of $10,000, with head office at Vancouver, B.C.

W. P. Scrim Lumber Company, Limited, has been incorporated with a capital of $50,000, with head office at Vancouver, B.C.

H. R. Goodday and Company, Limited, has been incorporated with a capital of $250,000, with head office at Quebec, Que., to carry on business as lumber merchants. The provisional directors are A. C. M. Thompson and W. F. Fanning, both of Quebec.

McKinnon, Mather and Hyslop Company, Limited, has been incorporated with a capital of $40,000, with head office at Toronto, to carry on business as general contractors. The provisional directors are W. R. Mather, C. F. and J. F. McKinnon, J. Parker and F. K. Hyslop, all of Toronto.

Builders' Cement Tiles, Limited, has been incorporated with a capital of $40,000, with head office at Hamilton, Ont. The provisional directors are J. G. Gould and C. V. Langs, both of Hamilton.

Rocmac Road Contractors, Limited, has been incorporated with a capital of $100,000, with head office at Toronto. The provisional directors are F. H. Keefer and N. E. Towers, of Port Arthur, Ont., and M. J. K. Allen and H. A. MacKay, of Toronto.

The Western Fireclay Products, Limited, has been incorporated with a capital of $100,000, with head office at Regina, Sask.

REID & BROWN
Manufacturers of
GARBAGE AND REFUSE INCINERATORS
Steel Beams, Channels, Angles, Plates, Column Sections, etc., Always in Stock
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Anglins Limited
GENERAL CONTRACTORS
65 Victoria St. MONTREAL
507 Lumsden Bldg. TORONTO

Municipalities

and others sending in tender advertisements for the Contract Record are requested to bear in mind that these must be in our hands by

Ten o'clock on Tuesday morning,

each week, in order to be published in the issue of the following day.

MacLean Daily Reports make business-getting quicker, easier, surer, cheaper. By using these reports you can cover more territory, get at more prospects, develop more business—in short, make more money. Send to-day for rates and sample reports.

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220 King St. West - TORONTO

Sale of Quarries, Quarry Plant, Etc.

at Beamsville and Crookston, Ontario

The Trustees of the Estate of the late Honourable William Gibson invite tenders for the purchase of the valuable Quarries situated at Beamsville, 22 miles from Hamilton and 12 miles from St. Catharines, consisting of 94 acres more or less; also at Crookston, 110 miles from Toronto, consisting of 14 acres more or less.

These quarries are those owned by the late Senator Gibson and contain a practically unlimited quantity of the finest limestone and hundreds of thousands of tons of chips suitable for immediate crushing. The Beamsville quarries have a complete tramway system from all parts of it to the G. T. R. Station with valuable franchises, while at Crookston the G. T. R. switch enters the quarry and the C. P. R. is about 500 feet away. Favorable freight rates enable both quarries to compete in the masonry and crushed stone markets of Hamilton, Toronto and Montreal.

Tenders will be received for any or all of the under-mentioned parcels but in the event of parcels 3 or 4 being acquired by tenderers other than the purchasers of the lands the successful tenderers must undertake with the Trustees to remove all the machinery, etc., within three months.

Tenders for parcels 1 and 2 will be considered either on a fixed basis or on a cash payment plus a royalty of so much a cubic yard of stone. The price on a fixed basis will be payable one-third cash, the balance in equal payments at one and two years with interest at six per cent.

Parcel No. 1

Quarry properties at Beamsville owned by deceased with tramway system in connection therewith and being composed of portions of Village lots in Beamsville and of lots in the Township of Clinton in the County of Lincoln, said properties having been conveyed to deceased by deeds registered as Nos. 574 and 304 (Beamsville) 2858, 2509, 2631, 2220, 3558, 2438, 4190, and 5238 (Clinton) and 1259, 1263 and 1268 (Beamsville) with 13 buildings, including office, carpenter and blacksmith shops, engine house, etc. Also three miles of tramway with the existing franchises in connection therewith.

Parcel No. 2

Quarry lands at Crookston containing by admeasurement 14 and 2/100 acres, being composed of part of lot Number Ten in the Ninth Concession of the Township of Huntingdon in the County of Hastings and more particularly described in the conveyance thereof to the said William Gibson dated 21st December, 1896, and registered as No. 5003 (Huntingdon) with all buildings situate thereon.

Parcel No. 3

Plant at Beamsville:
- 12 hoisting engines with boiler and equipment.
- 7 power derricks with equipment, masts 65 to 75 ft.
- 5 pneumatic rock drills.
- 1 centrifugal pump.
- 2 Champion road engines.
- 5 road scrapers.
- 23 tram cars.
- Tools, tool boxes, blocks, pipes, valves, ropes, wires, etc.
- 16 double drum portable horsepower hoists
- 4 hand power derricks, masts 18 to 35 feet.
- 6 blacksmith's forges.
- 1 sand pump.
- 1 6 x 16 ft. Blake pattern stone crusher.
- 3 dump cars.
- 200 yds. of dressed and partly dressed stone.

Parcel No. 4

Plant at Crookston:
- 2 dynamos.
- 1 stationary boiler and equipment.
- 1 single horizontal steam piston pump.
- 4 derricks.
- 1 rock drill.
- 1 hoisting engine with boiler and equipment.
- 4 horse-driven hoists with equipment.
- Pipe, tools, etc., etc.

Detailed inventories may be seen at the office of Mercantile Trust Company of Canada, Limited, in Hamilton or of Messrs. Jennings & Clute, 906-910 Traders Bank Building, Toronto.

A cheque for $500, payable to the Estate of Hon. William Gibson must accompany each tender. The highest or any tender not necessarily accepted.

The Trustees reserve the right to sell privately the whole or any part at any time.

Dated at Hamilton this 20th day of July, 1914.

For the Trustees

Mercantile Trust Company of Canada, Limited

Bank of Hamilton Building, Hamilton, Ont.

JAMES THOMSON, President. J. G. ALLAN, Vice-President. JAMES A. THOMSON, Secretary.

THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.
LIMITED

Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

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Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
Toronto Ontario

Before You Buy Expensive Pipe Get Our Prices on Butted Tubing

You will find that it is far more economical in cost than ordinary pipe and will answer every possible requirement for which you might buy more expensive material.

We are in a position to make immediate shipments, and we suggest that you send for prices and full particulars about our butt joint and structural tubing.

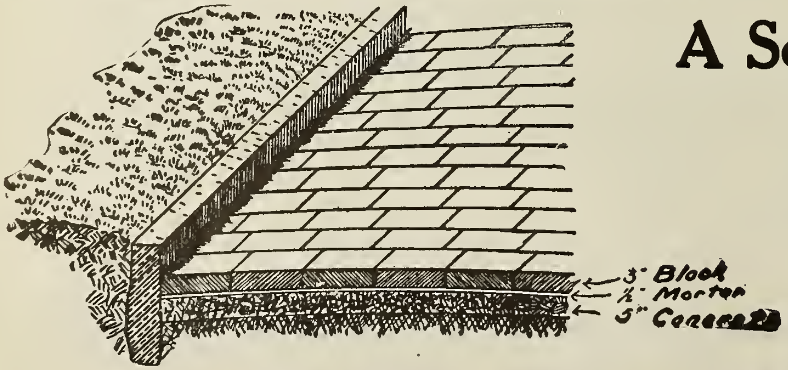
Standard Tube & Fence Co., Limited
Woodstock, Ontario
Manufacturers of
Butt Joint and Structural Tubing, Trolley Pole Arms, Sleeves for Reinforcement Rods, Fence Posts, Woven Wire Fence, Gates and Fence Supplies

RAILS New and Relaying Switches, Turntables, Etc.

Carried in Stock

Locomotives and Cars

Jno. J. Gartshore, Toronto



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Durable and Non-Abrasive.
Non-Absorbent and nearly Noiseless.
Unaffected by extremes of Temperature
Sightly and Sanitary.
Easily Repaired and easily Cleaned.

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Every new building should be equipped with Luxfer Prisms in order to get daylight into the interior.

Once installed "Luxfer" costs nothing to maintain. Luxfer sidewalk prisms are set in wrought iron frames which cannot warp or sag.

Luxfer is the one prism that will give definite results—no guess work.

Always specify the same system—Luxfer

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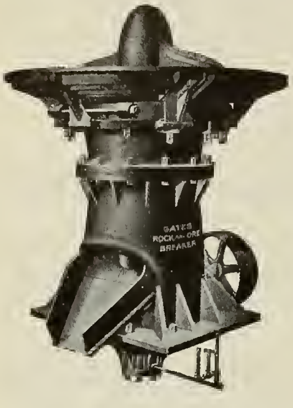
ROCK CRUSHING PLANTS

JAW OR GYRATORY BREAKERS



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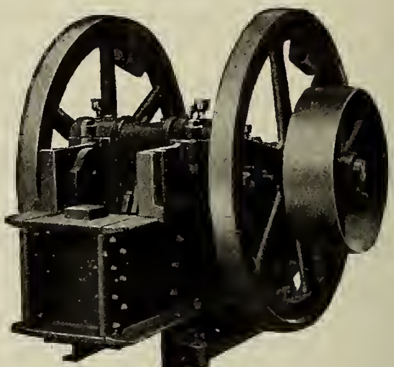
We design and build complete rock crushing plants of any capacity, including crushers, screens, elevators, conveyors and power equipment. See Bulletin 1411. Head Office, Toronto: Sales Offices, Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert.



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We build all kind of Cranes for

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Complete Outfits for
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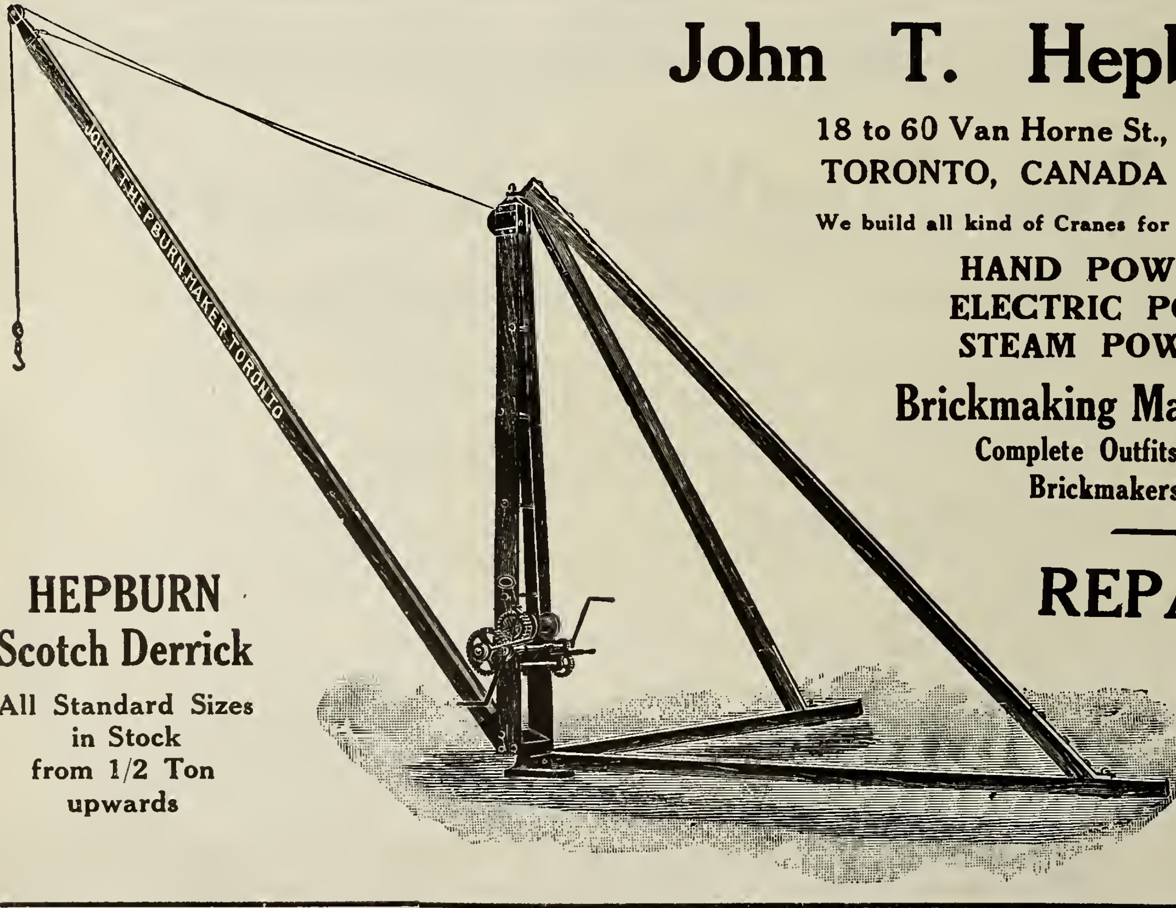
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Scotch Derrick

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in Stock
from 1/2 Ton
upwards

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In choosing

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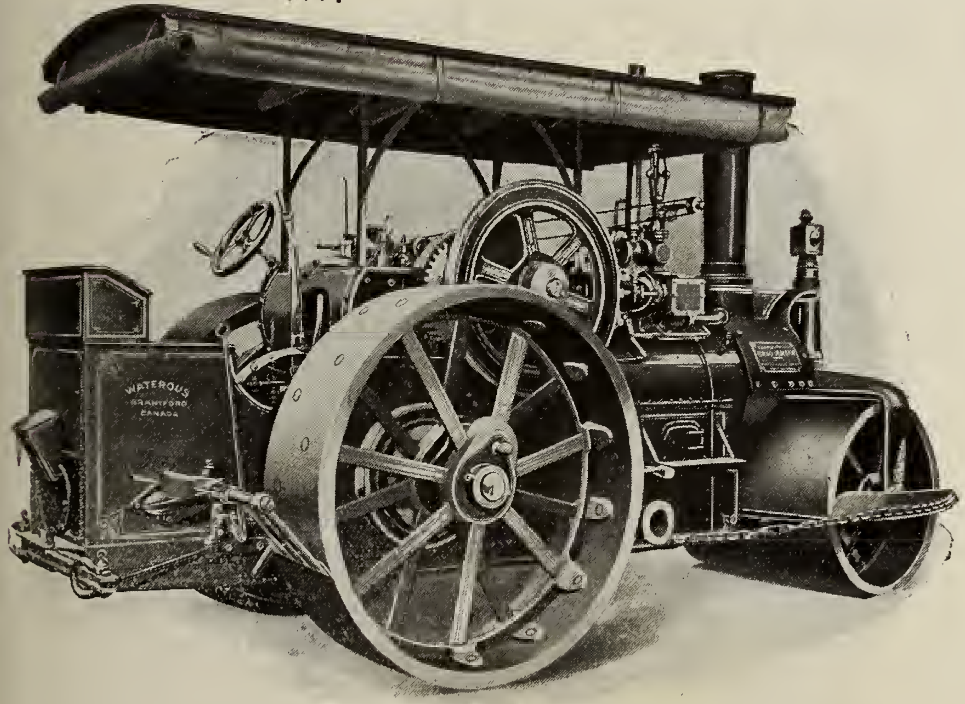
your selection is supported by the indorsement of more than 175 users, among them the leading municipalities and foremost contracting engineers and road builders of Canada.

These men have used the Waterous Roller with unfailing success —**many of them for more than fifteen years**—and are willing to back up their acknowledged preference by records of performance unequalled by any other make of Roller, Canadian or foreign, on the market.

If reputation and achievement have any weight with you—your choice will be a Waterous. **And you will be glad of it.**



Bulletin No. 301

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"Leader" Line of Concrete Machinery
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Church, School, Fire and Farm Bells. The only bell foundry in Canada.
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All the features of ordinary cast iron pipe and some exclusively our own. Interlocking and Self-supporting, double flanges where halves come together, halves fastened by lugs or bolts; arrangement of ribs, etc. Absolutely self-supporting, sectional and easy to handle, top sections removable, easy to clean, smooth inside surface, great water carrying capacity, no tools required for assembling, non-corrosive, maximum durability.

This is the feature that should be of great interest to engineers and municipalities in Canada as this pipe will expand during winter weather preventing the cracking and breaking that is so common in solid round culverts.

Made of best grade Northern Pig Iron, will not rust or corrode. In four-foot sections, or two-foot sections when wanted. Furnished in sizes from 8 to 36 inches.

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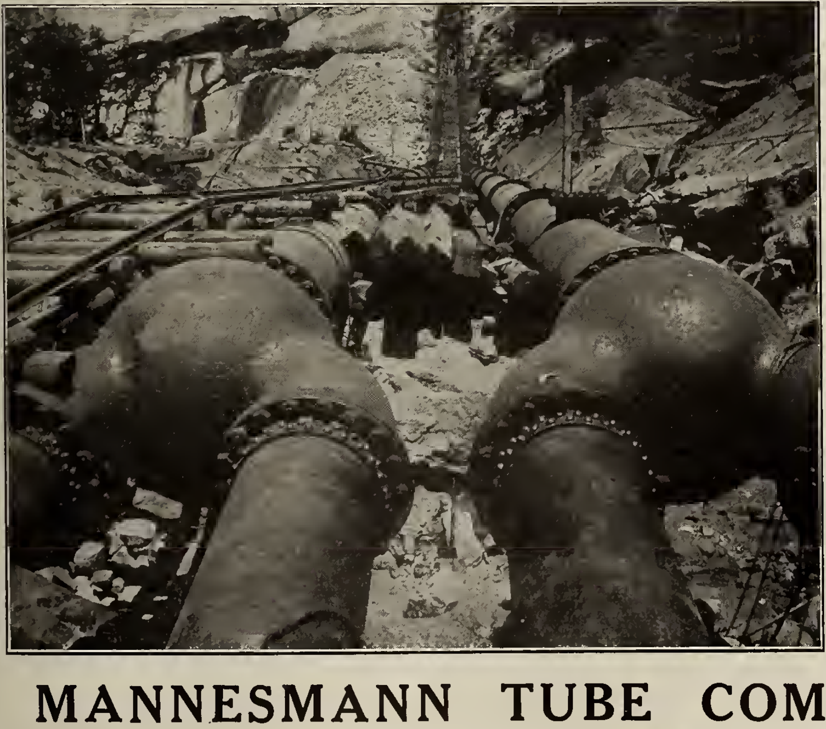

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Are Specified by the
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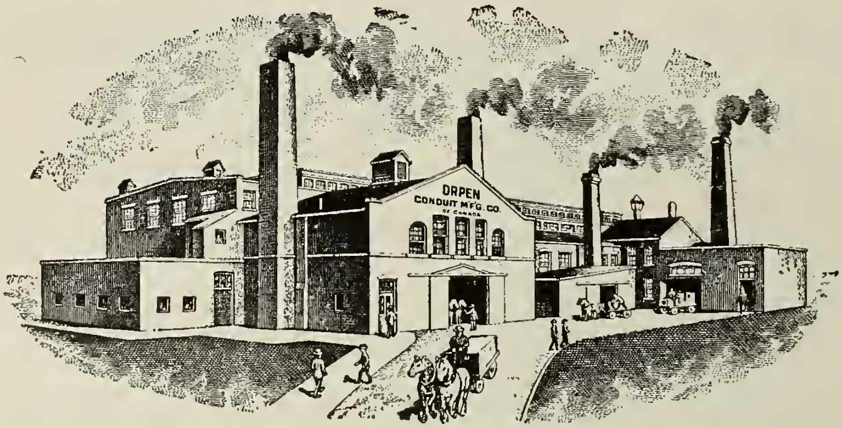
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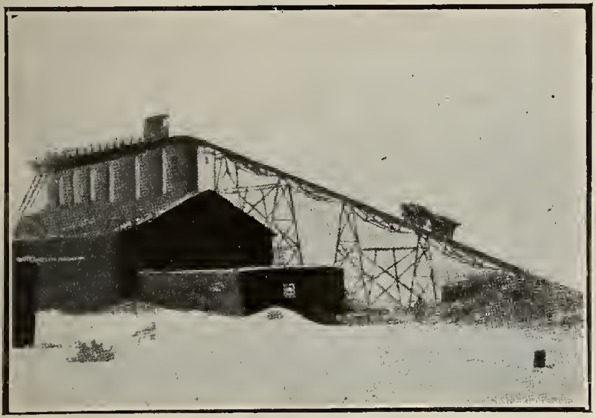

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You always have fresh lime when you use Hydrate

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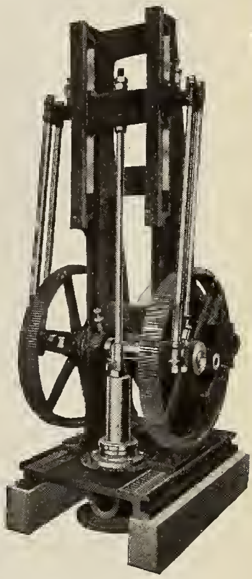

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Write for Bulletin 26 explaining the use of Cook's Patent Brass Tube Well Strainer.

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Scrapers and Concrete Carts

are strictly **high grade**. Are built to meet **all requirements** of the building trade.
The price is exceedingly low considering the quality.

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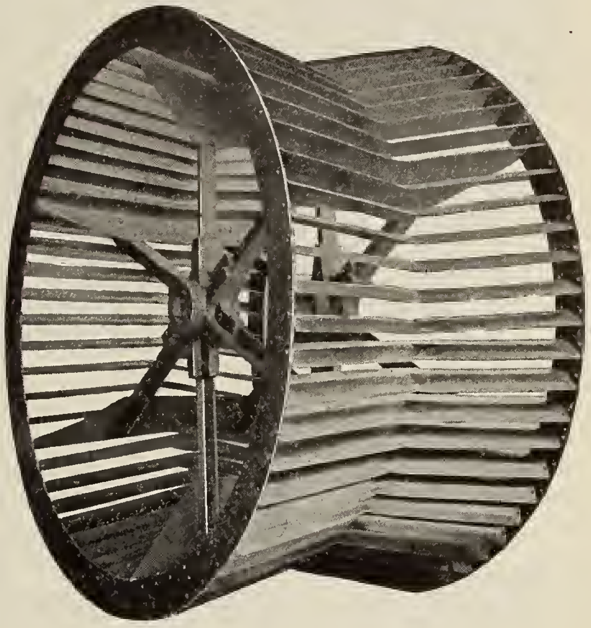

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A Fan that will give continuous satisfactory service at a minimum power consumption.

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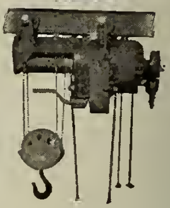

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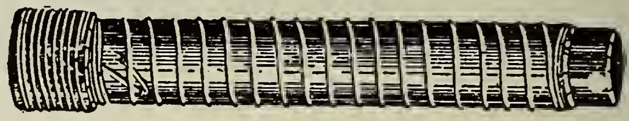

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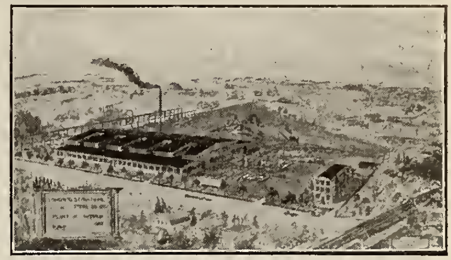

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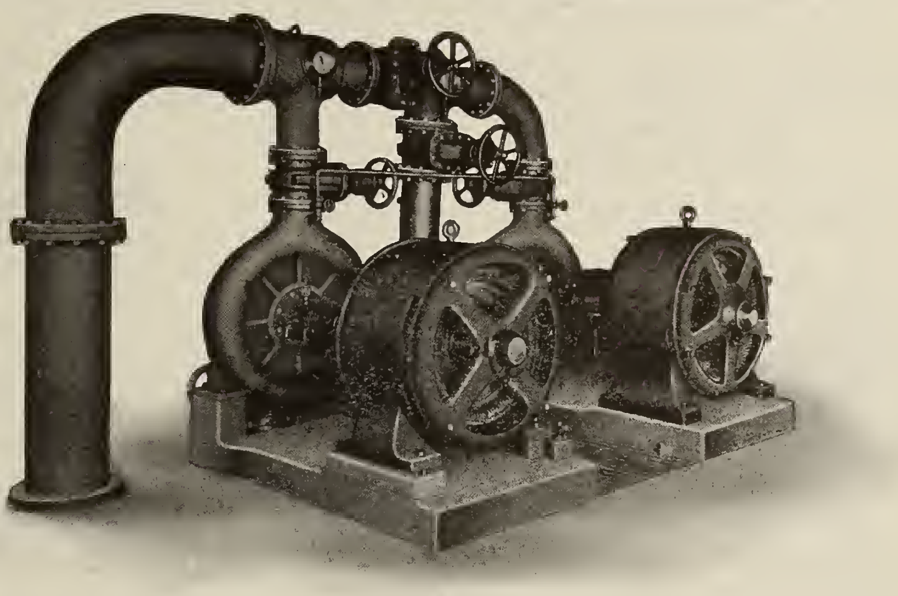

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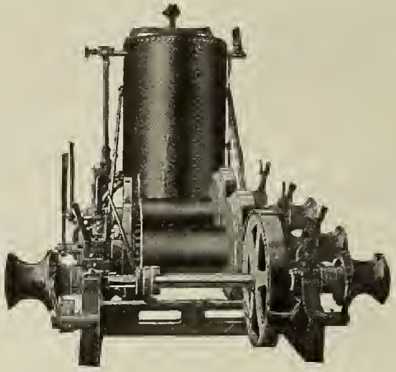

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Prompt Shipment

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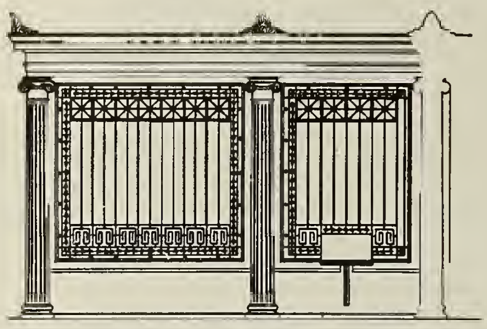
In Ornamental Iron and Bronze



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has a 25% factor of safety over the same size of any other make. A swell of 25% added material at the weld makes that point the strongest part of the link.

Guaranteed to pull stiff before breaking and not to break at weld.

Sizes 3/16" to 3/4" inclusive.

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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Towers and Tanks for all purposes.

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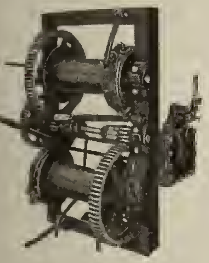

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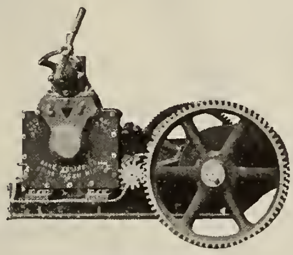

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ANNUAL CAPACITY 36,000 TONS, Shop "A" 18,000 Tons, Shop "B" 6,000 Tons, Shop "C" 12,000 Tons
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460 feet x 8 feet 2 in.

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will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a HEINICKE.

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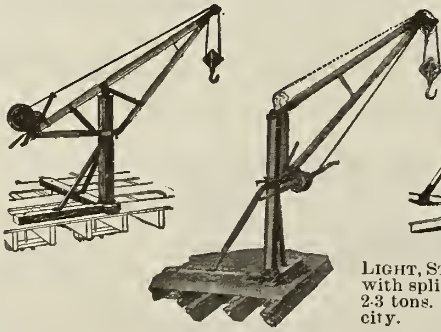

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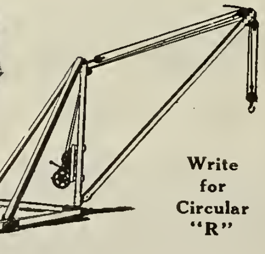

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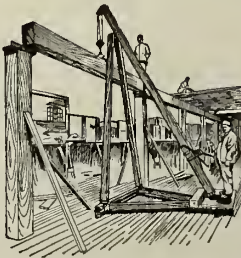

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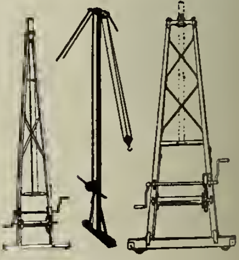

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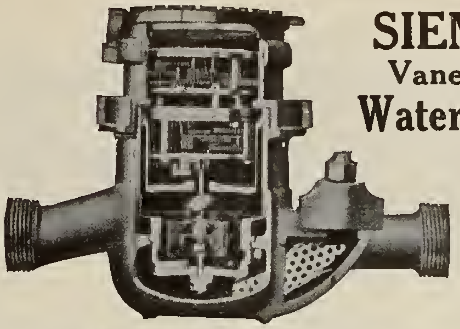

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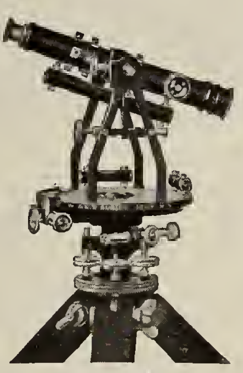

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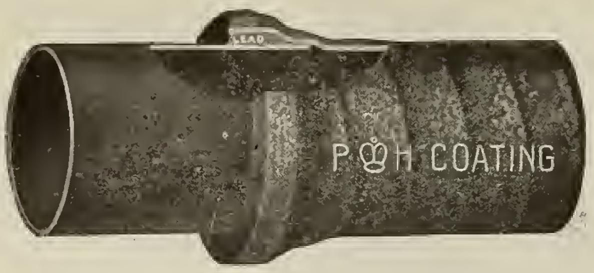

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Made in sizes from 2″ to 10″ inside diameter with different thicknesses for varying pressures.

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50,000 gallons. 149 feet to top
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Current Prices of Building and Engineering Materials

General Review of Trade and Market Conditions

THOSE who were optimistic enough to predict that a substantial improvement in building trade conditions in Toronto would materialize during the summer months have had their anticipations realized to some extent by the course of events in the constructional field in the last few weeks. Developments during July in almost every section of the trade have shown a perceptible upward tendency judging from reports to hand in regard to building operations, and the amount of business handled in the last couple of weeks by dealers in building materials. It cannot be said, however, that there is any indication of unusual constructional activity, but at the same time a fair volume of work is going steadily on. The building permits issued for some weeks past have been mainly for houses under $5,000 in value, so that the tendency would seem to be in favor of a policy of greater moderation in carrying out speculative construction work.

Building materials, on the whole, are in greater demand than has been the case for some months past. There has been practically no change in the prices of brick and the principal manufacturers report a fair volume of business considering the prevailing conditions. Dealers without exception are looking forward with confidence to a much better year than the last twelve months proved to be. Several of the brick plants are reported to be working at capacity. Sewer pipe is in good demand in and around Toronto and the probabilities of a normal year are not hy any means remote in view of the amount of sewcrage work at present in progress. The market for cement has not changed to any appreciable extent since last month and the prevailing opinion in the trade is that business in the first six months of the present year has equalled the corresponding period of 1913, and that the balance of the year will eclipse the last six months of 1913 in the volume of business done. The movement in steel, howcver, continues to be very dull, owing to the lull in steel construction work. There does not appear to be any prospect of immediate improvement and conditions in this line are the reverse of promising. Lime continues in fair demand, but the amount of business done in Toronto this year will probably be ten per cent. less than was the case this time last year. Large orders are more numerous at present than was the casc a month ago, and continued improvement towards the fall is confidently looked for. The same is also true of sand, gravel and crushed stone. The situation with regard to paints and oils shows evidence of fluctuation. Raw oil is slightly better in price than it was a couple of weeks ago, but lower than in May. To sum up the situation the outlook continues bright, though it is not anticipated that unusual building activity will develop this year. At the same time it is generally believed that business at the present time is on a sounder basis than has been the case for some considerable time past.

At Montreal, the building trade is by no means brisk, although a few contracts of comparative importance have been given out. The threatened labor troubles during the past month have been disturbing factors. These are now settled, but the increased wages conceded make for the higher cost of building, and this of course tends to restrict operations. For a time it looked as if there would be general strikes of the carpenters and bricklayers and it was only after prolonged negotiations that settlements were come to. Under an agreement, the former workmen receive an addition of 2½c, making 45c an hour; this rate will continue for one year, and for the two following years the rate will be fixed by an arbitration board, to consist of three representatives on each side, with an independent chairman, who is to be appointed, in case of disagreement, by the Minister of Labor. After the first of August the General Contractors' Association agreed not to submit their carpentering work to any subcontractor who does not employ union men at the standard rate of wages. The hours of labor are to be nine in the summer and eight in the winter. The bricklayers have also come to an arrangement with the General Contractors' Association, under which the wages for this year are 55c an hour, for the next year 60c, and for the third year they are to be determined by arbitration. The working hours will be nine in summer and eight in winter, with Saturday afternoons off throughout the year.

There is only a moderate demand for general builders' supplies. Crushed stone is in a little more active request and orders for brick have increased in volume. For a time the threatened general strike of the men adversely affected business, but since the settlement trade has revived. As compared with three months ago, there has been quite a satisfactory improvement in the brick business, and the unfilled orders of the National Brick Company of Laprairie showed a distinct gain. Cement has been purchased on a fair scale, and the outlook for the material is good, in view of the increased uses to which it is being put.

Prospects in the iron and steel trades are more hopeful. The orders placed with the principal producing companies show a considerable improvement, and the plants are likely to employ their men on full time. According to Mr. T. Cantley, vice-president of the Nova Scotia Steel Company, orders during June were larger than for any preceding six weeks of the current year. In the light of the very satisfactory increase in orders during the last few weeks, Mr. Cantley feels confident that the worst is over and that continued improvement can be expected from now on.

The lumber business is showing a little more life. Buying, however, is in comparatively small quantities, and is, as a rule, only for immediate requirements. The export season is one of the worst for many years, and the total shipments to Europe are likely to show a very large decrease.

At Winnipeg, a fair general demand for the materials of construction is still maintained. A slightly freer movement of lumber is reported, although conditions in the industry leave a good deal to be desired. Market conditions are unchanged, and prices are still quoted as previously. Firms handling cement report a fair call for this product at the current prices, $2.60, and $2.30 for carload lots. The demand for lime is rather brisker, and plaster of Paris and hard wall plaster are both moving in greater volume. Brick is still in good demand, although recent reports are to the effect that there is some falling off in this direction. Prices remain unchanged.

Reinforcing bars and steel joists and girders are in rather better demand at a price of 5 cents per 100 lbs less than that last quoted in thesc columns. Crushed stone, sand and gravel arc moving in normal volume.

At Vancouver, thc situation as affecting most lines of building and engineering supplies has undergone practically no change since last month. This is particularly true of the brick, lumber and steel and iron markets, which at the present time, and in fact for several months past, have betrayed little real activity, although prices in every instance are being steadily maintained with no prospect of any weakening taking place in the immediate future. In steel and iron, while it is true that business is generally dull about this season, the demand prevailing is of such an unsatisfactory nature, and the outlook so uncertain, that dealers hesitate to predict any improvement inside the next six weeks at least. Cement, crushed stone, sand and gravel, continue in fair demand on account of the large paving contracts under way in the city, but the movement of these lines could not be called brisk by any means. There appears to be more vitality in the demand for paints and oils this month, due in some measure to the action of the Vancouver School Board in having all the city schools thoroughly renovated and painted during the summer holidays. The present spell of good weather is assisting trade to a considerable extent and there is every indication that July and August will prove far more active months than June. Owing to the delay in starting operations on a number of large contracts which should have been under way this month, the market for plaster, lime, slate and other supplies is not as active as had becn anticipated. While there is undoubtedly room for considerable improvement, business in these lines at the Coast continues to be steady and of fair volume with prices firm. The outlook is for a continuation of these conditions with, of course, the expectation of increased activity should the building situation become somewhat livelier than at present. Orders for sewer pipe are reported fairly numerous and although small compared with this time last year, the volume of trade is regarded as satisfactory. The curtailment of a large amount of sewerage work this summer at a number of points in the province naturally militates against any noteworthy activity in this market at the present time. The movement of lumber continues very slow with prices unchanged.

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $30; sand-lime brick, $8.60, King Edward Siding; $7.50 at the mill; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 6 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 64c per gal. of 9 lbs.

Raw linseed oil—in bbls., 61c per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 70c.

MONTREAL PRICES

CEMENT, LIME AND BRICK

Cement—$1.90 steam car load lots, including sacks.

(Continued on page 106)

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Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
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Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

Purchase MEXICAN EAGLE ASPHALT because:

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Samples, prices, analyses, etc., on request

The Asphalt and Supply Co., Limited

Sole Canadian Agents for the Mexican Eagle Oil Co. Limited
103-107 Board of Trade Building :: MONTREAL

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from p. 104.)

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $24, red $24, buff $25, white $47, plain pressed $12 per thousand, all f.o.b. Montreal.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2. $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15c basis per pound; British manilla, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 66c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car-load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 lbs.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.85 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Harner Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $8.85 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.75; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

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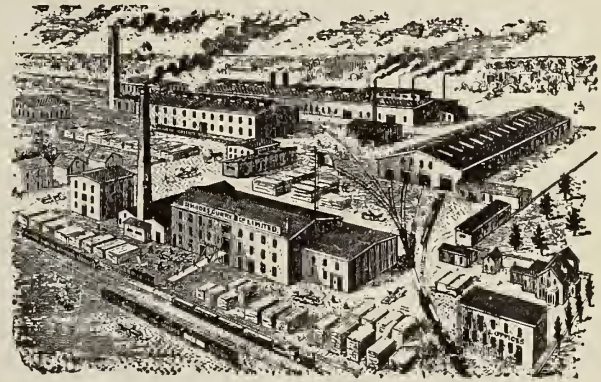

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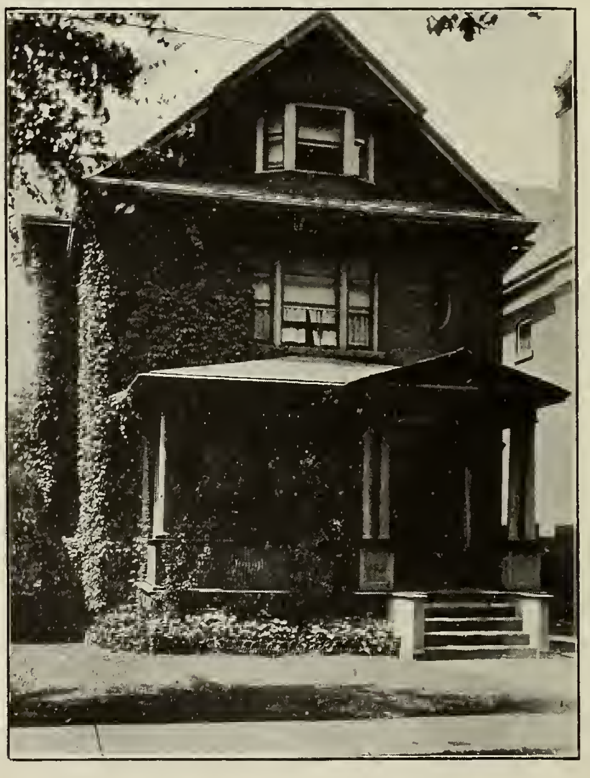

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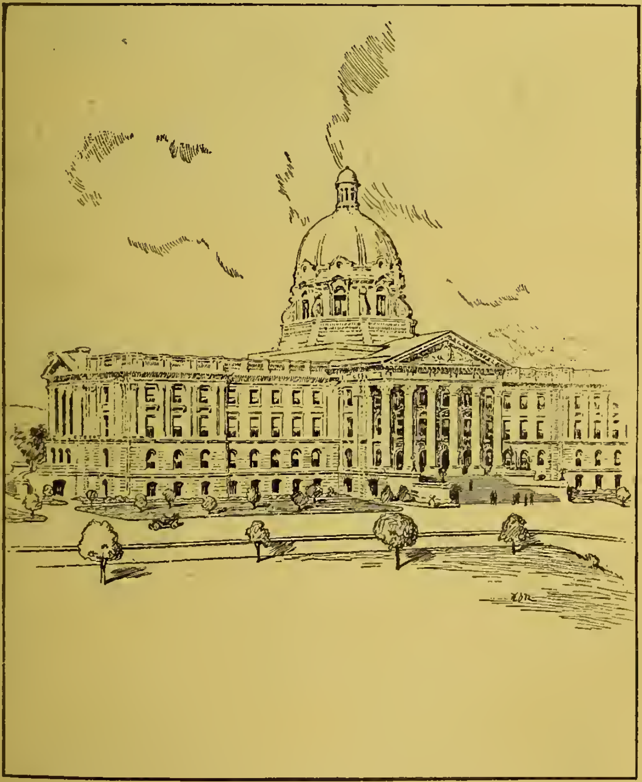

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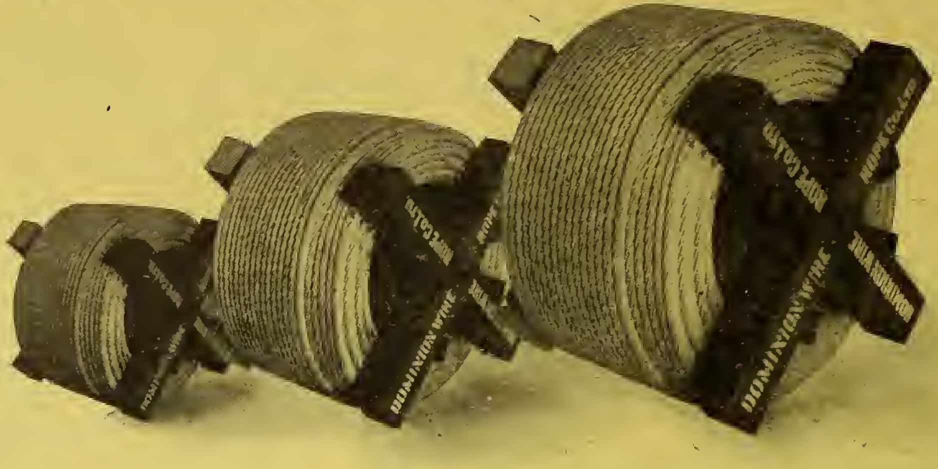

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Vol. 28 Toronto, August 5, 1914 No. 31

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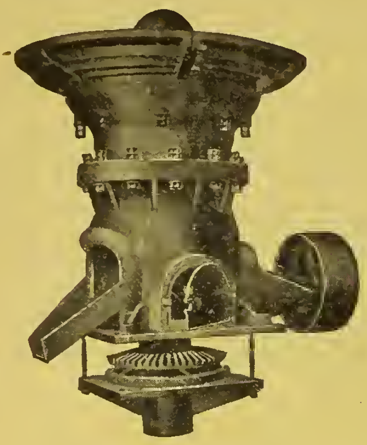

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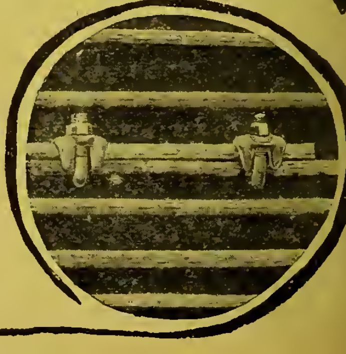
Here is how the "CROSBY" Clip is used to connect reinforcement bars



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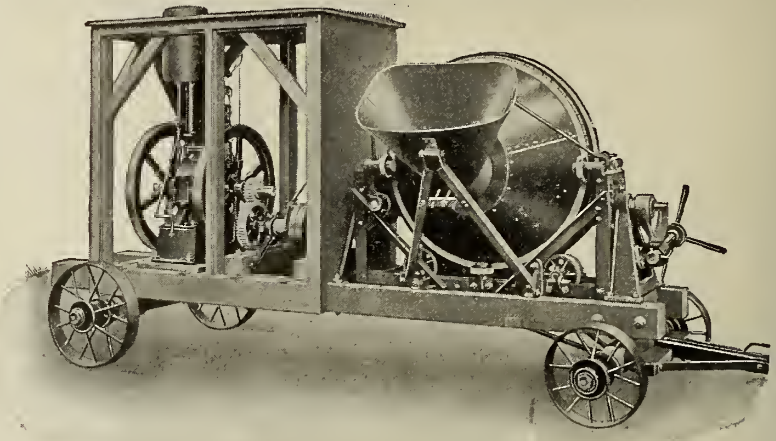
Smith Mixers

Never Fail



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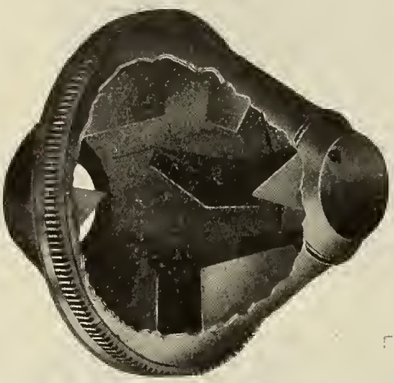

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The design of the "SMITH" is mechanically correct and practically no repairs are required.

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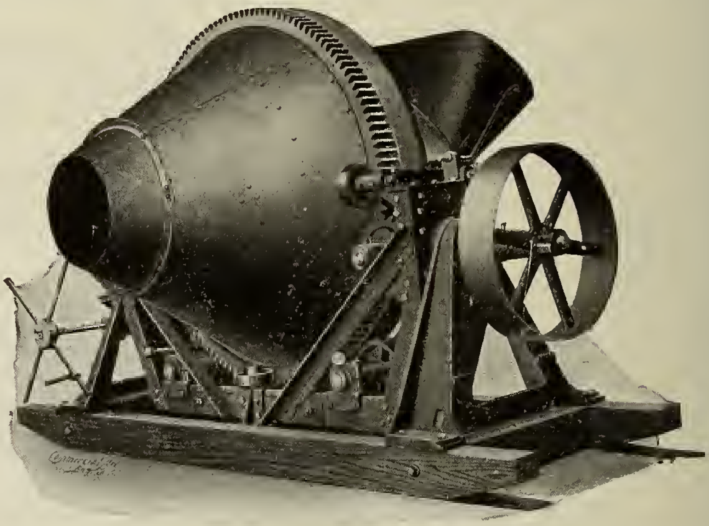

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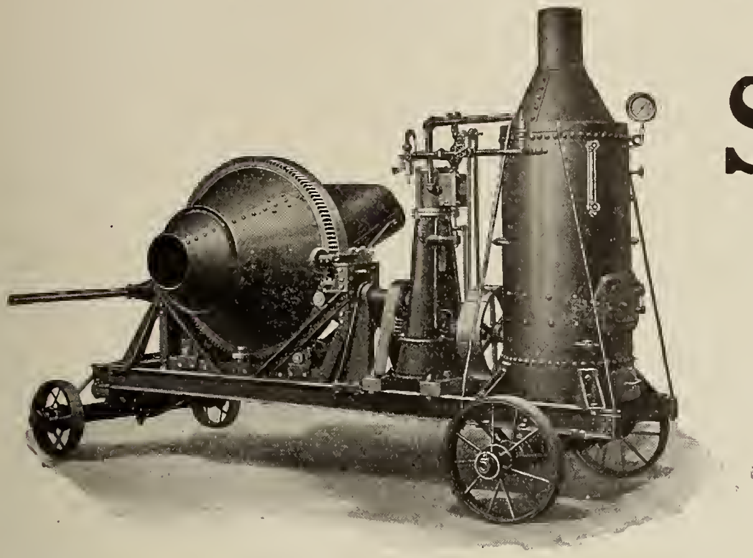

Standard Smith Mixer on Trucks with Boiler and Engine

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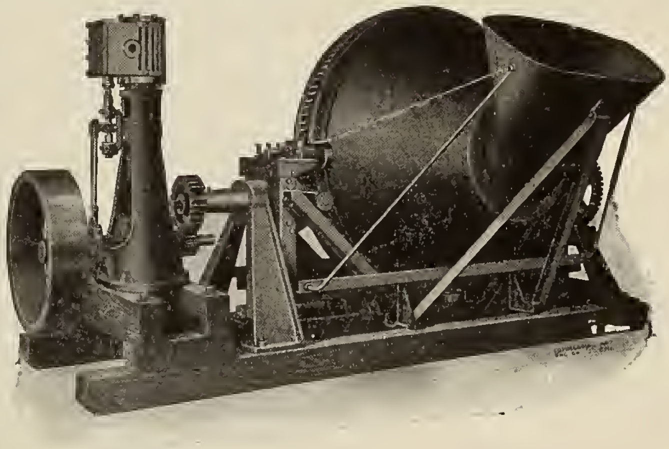

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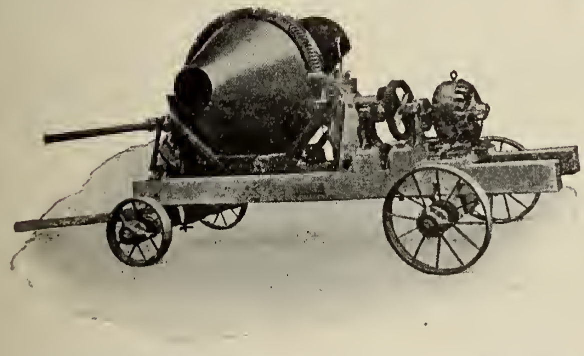

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Morrison & Co., T. A.
Ontario Lime Co., Ltd.
Smyth & Ryan

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Dougall Varnish Company
Wadsworth Howland Co.

Cement Mill Machinery
Hull Iron & Steel Foundries
Jenckes Machine Company
Sutcliffe, Speakman & Co.

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Abram Cement Tool Co.

Chain
McKinnon Chain Company

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Morris Crane & Hoist Co., Herbert

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Laurie Company, E.

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Galt Stove & Furnace Co.
Manitoba Bridge & Iron Works

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Browning Company
Brown Hoisting Machinery Co.
Weller Mfg. Company

Concrete Form Clamps
Railway Contractors Supply Co.

Concrete Machinery
Canadian Zagelmeyer Co.

Concrete Mixers and Appliances
Austin Drainage Excavator Company, F. C.
Badger Concrete Mixer Co.
Canadian Allis-Chalmers, Ltd.
Goold, Shapley & Muir Co.
Hopkins & Co., F. H.
Jaeger Machine Company
Koehring Machine Co.
Lecky & Collis
London Concrete Machinery Co.
Marsh Capron Company
Mills Bros.
Municipal Engineering & Contracting Co.
Mussens Limited
Power & Mining Machinery Co.
Rock & Power Machinery
Sutcliffe, Speakman & Co.

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Dietrich Limited
Eastern Pipe Construction Co.
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Can. Billings & Spencer
Canadian Fairbanks-Morse Co.
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Canadian Brakeshoe Co., Ltd.
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Dake Engine Co.
Dominion Lime Company
General Car & Mach. Works
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Hepburn & Co., J. T.
Honig & Mock
Hopkins & Co., F. H.
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Koehring Machine Co.
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Radigan Company, John
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Orpen Conduit Co., Ltd.
Ric-wiL Underground Pipe Covering Company

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Crushed Stone and Granite
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Lecky & Collis
London Concrete Machinery Co.
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Sutcliffe, Speakman & Co.

Culverts
Pedlar People

Cupolas (Foundry)
Northern Crane Works

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Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 12)

Niagara Falls-Buffalo Boulevard
paved with Bessemer Brick.

When You Buy Bessemer Block You Buy Four Inches of Wearing Quality

THE constantly increasing use of automobiles and large motor trucks and the heavy demands now made upon all roads has made

BESSEMER
Wire-Cut-Lug Paving Block

an imperative necessity for road paving. BESSEMER BLOCK is also an economy. They produce smooth durable roads which resist wear and outlast all other road building materials. The rough sides of the wire-cut-lug block afford an excellent binding surface for the cement grouting, thus securing a strong, uniform monolithic surface.

We will gladly supply full information. Your request is cordially invited.

Bessemer Limestone Company
Manufacturers of Bessemer Repressed and Dunn Wire-Cut-Lug Paving Blocks
Youngstown, Ohio

Canadian Agents G. W. ESSERY, 47 Yonge Street, Arcade Building, Toronto, Ontario
STINSON-REEB BUILDERS SUPPLY CO. Montreal, Quebec.

Head Office and Works

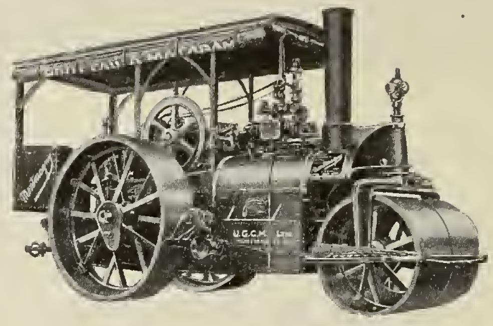
"Montmagny" Modern Road Builders

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



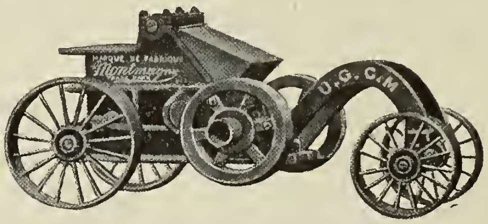
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"



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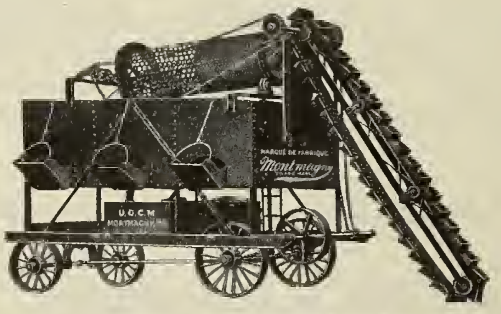
Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.



"Montmagny" Portable Steel Bin.

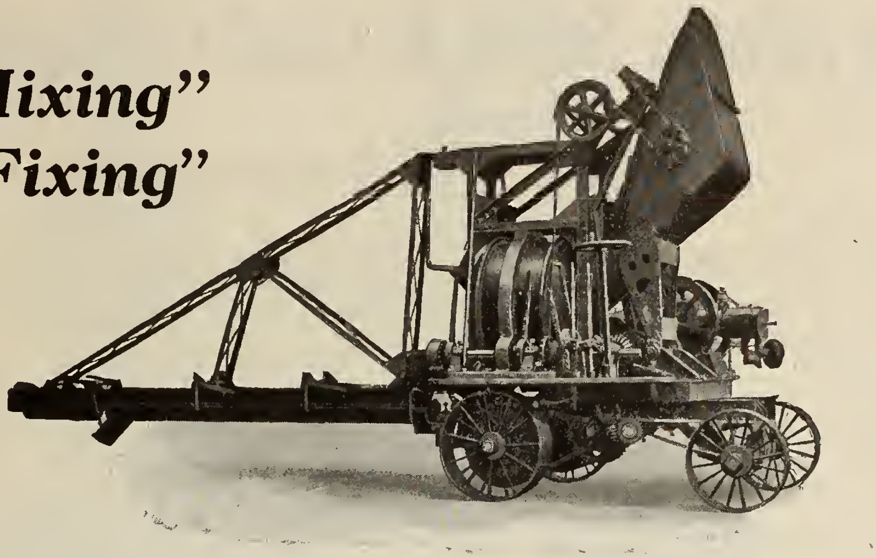
Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

"Most Mixing"
"Least Fixing"



M-C Rail-Track Paver, With Gasoline Engine, Showing Mixing Distributer.

M - C Rail - Track Paver

Points too valuable to overlook. Compare them with those on other machines. That's all we ask.

Traction

12 horse-power steam or gasoline engine;
Two speeds ahead, one speed reverse;
Heavy brakes like on auto trucks;
Powerful differential;
Extra large wheels;
Right height to pass under city viaducts;
Drives like a traction engine, up hill or down;
Sell your horses—you don't need 'em.

Operation

Perfect one man control;
Engineer works in one natural position;
No stooping or stretching;
Engineer rides when traveling;
Levers all at fingers' ends;
No expert needed to handle distributor;
Safety first—gears covered.

Capacity

Continuous mixing;
11 to 12 cu. ft. of wet mixed concrete, or 2 bags 1-3-5 per batch;
Daily capacity, 1200 to 1400 street yards, 6 ins. thick.

Mechanically, the M-C Rail-Track Paver is as well built as we know how to build it. It has all the strong features of the M-C standard mixers:—**Semi-steel Drum, Steel Rail Tracks; Segmental Gear; Dustproof Roller Bearings, Etc., Etc.**

Send for free catalog explaining it in detail

CANADIAN FAIRBANKS-MORSE CO., Ltd.

Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

Manufactured by

Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

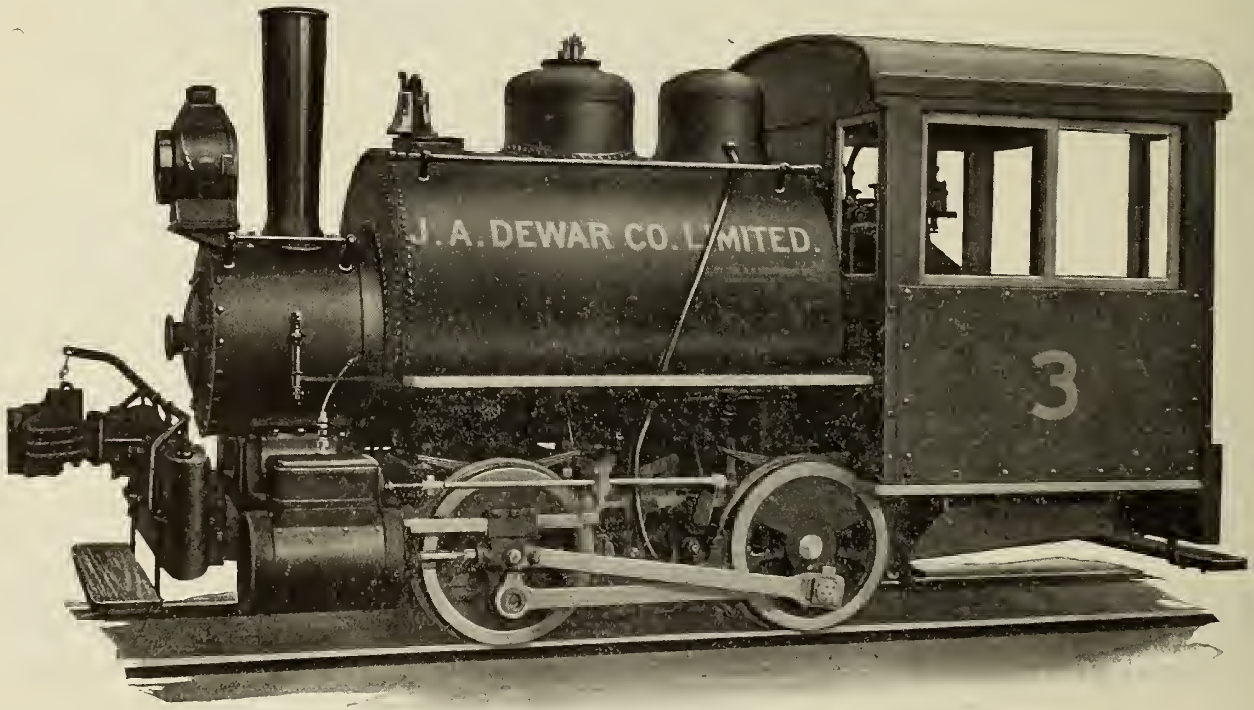
These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

Head Office - - New Glasgow, N. S.

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

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Rock Crushers

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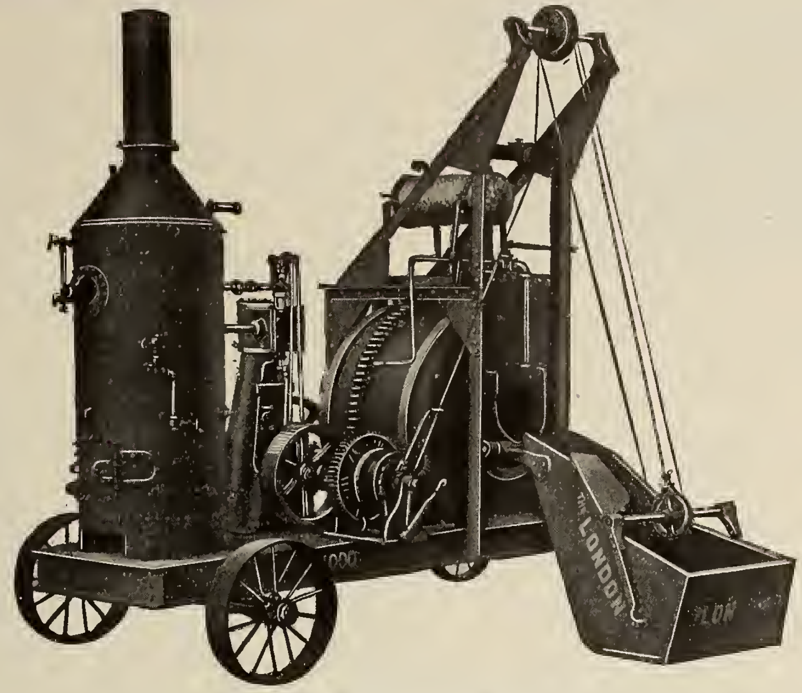
Pumping Outfits

—

Hoists and Derricks



London Standard Drum Batch Mixer
This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

Concrete Mixers

—

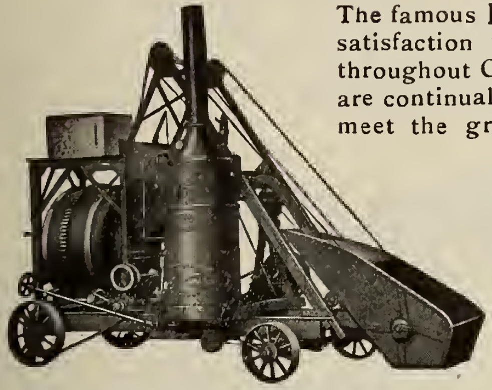
Mortar Mixers

—

Concrete Block Machines

—

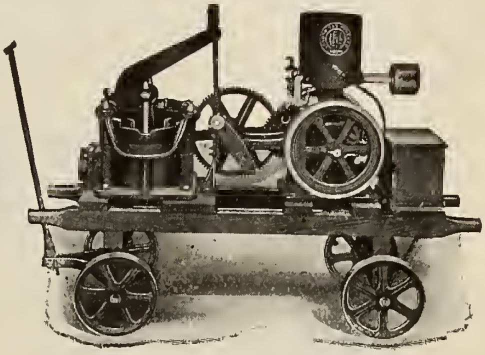
Cement Brick Machines



Rear Discharge Paving Machine with Forward Loader

The famous **London Mixers** are giving satisfaction to contractors and others throughout Canada. For this reason we are continually increasing our output to meet the growing demand for London Concrete Machinery. From time to time we have been obliged to extend our plant until today we are generally accounted the largest manufacturers of concrete machinery in Canada.
We also manufacture a full line of hoisting engines and contractors' equipment.

CORRESPONDENCE SOLICITED



Diaphram Pump with Power

The London Concrete Machinery Co., Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES :
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Calgary—622 9th Ave. West—P. D McLaren, Manager.
Toronto—112 York Street—G. B. Oland, Manager.
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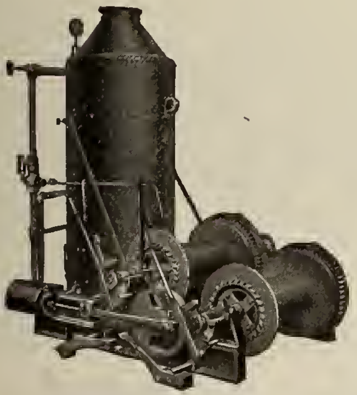
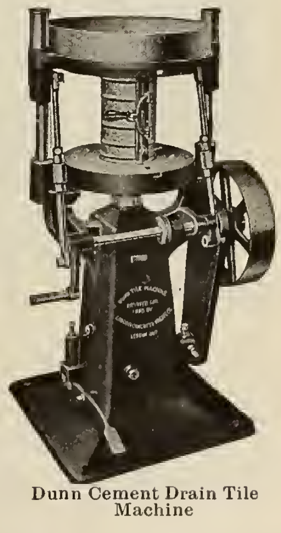
Port Arthur and Fort William, Ont.—Northern Agency & Equipment Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.



Standard Hoisting Engine

the Largest Manufacturers of Concrete Machinery in Canada



Dunn Cement Drain Tile Machine

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- Canadian Billings & Spencer, Ltd.

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- Schell Foundry & Machine Co.
- Sheldons Limited
- Western Wheeled Scraper Co.

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- Sturtevant Co. of Can., Ltd., B. F.

Electric Air Rock Drills
- Canadian Ingersoll-Rand Co.

Electric Impulse Clocks
- Gent & Company

Electric Steel Castings
- Electric Steel & Metals Co.

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- Roelofson Elevator Works
- Turnbull Elevator Co.

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- Boving Company of Canada
- Canadian Buffalo Forge Co.
- Canadian Sirocco Company
- Inglis Company, John
- Jenckes Machine Company
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- Leonard & Sons, E.
- McDougall Caledonian Iron Wks.
- Mussens Limited
- Rock & Power Machinery
- Waterous Engine Works Co.

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- Cape Company, E. G. M.
- Chipman & Power.
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- Lea & Ferguson
- Mitchell, C. H.
- McDougall, Geo. K.
- Pullar, H. B.
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- Tyrrell, H. G.

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- Austin Drainage Excavator Company, F. C.
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- Municipal Engineering & Contracting Company
- Parsons Company, G. W.

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- Canadian Buffalo Forge Co.
- Sheldons Limited

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- Sheldons Limited
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- Mannesmann Tube Company
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- Browning Company
- Brown Hoisting Machinery Co.
- Canadian Allis-Chalmers, Ltd.
- Canadian Fairbanks-Morse Co.
- Canadian Ingersoll-Rand Co.
- Jenckes Machine Co.
- Hopkins & Co., F. H.
- Lecky & Collis
- Marsh & Henthorn
- Morris Hoist & Crane Co., Herbert.
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- Rock and Power Machinery
- Royce Limited
- Sturtevant Co. of Can., Ltd., B. F.

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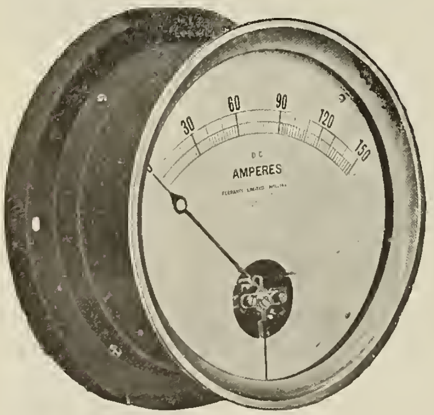


INSTRUMENTS

This

OPEN DIAL METER

IS—Cheap
Accurate
Handsome
Well finished
Easy to read
Moving Coil or
Moving Iron type

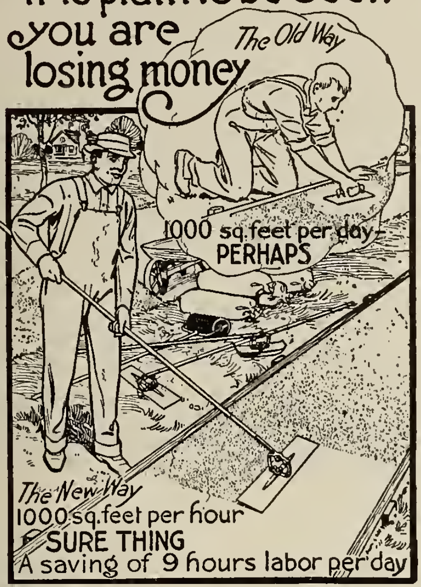
In short—**IT IS THE BEST OF ITS KIND**

Ferranti Electrical Co. of Canada, Limited

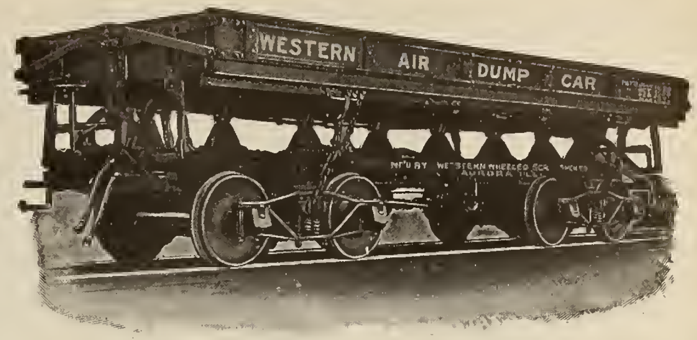
Head Office:—**90 Sherbourne St., TORONTO**

Branches:—**704 Unity Bldg., MONTREAL**
Farmers Advocate Bldg., WINNIPEG

If you are not using
"ABRAM" TOOLS
It is plain to be seen
you are
losing money



Abram Cement Tool Co.,
Windsor, Ontario



WESTERN DUMP CARS

constitute the most modern means for receiving, transporting and depositing earth, stone or other material.

The Western car is ahead of all other dump cars in points of economical operation, quality of material used, freedom from derailment, durability and superiority of mechanical design in general.

Strong endorsement of these claims was furnished by the engineers in charge of the Panama Canal when they selected Western Dump Cars for handling material during excavating operations.

Illustrated catalogue containing full technical information on request.

Western Wheeled Scraper Co.
AURORA, ILLINOIS
Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta
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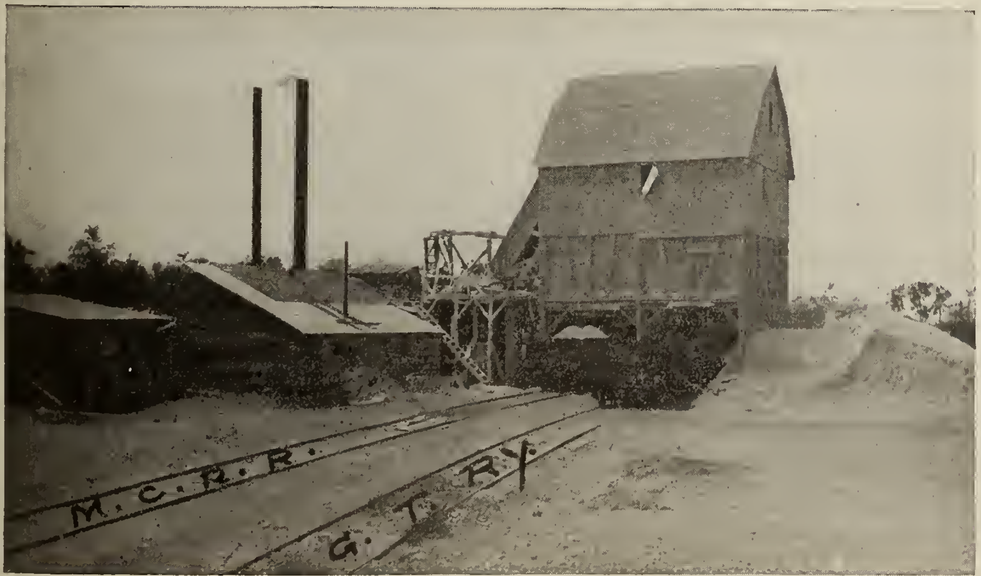
Macadam Roads



must be built of a
Tough Stone
that will cement
WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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- Northern Crane Works

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- Canadian Fairbanks-Morse Co.

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- Gartshore-Thomson Pipe Co.
- Kerr Engine Company

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- Canadian Sirocco Company

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- Jamieson Lime Company
- Ontario Lime Company, Ltd.
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- Central Locomotive & Car Works
- Canadian Allis-Chalmers, Ltd.
- Canadian Locomotive Company
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- Mussens Limited

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- Ferranti Electrical Mfg. Co.
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- Neptune Meter Co.
- Peacock Brothers
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- Canadian Pipe Co.
- Dominion Concrete Co.
- Gartshore-Thomson Pipe Co.
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- National Pipe & Foundry Co.
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- Sheldons Limited
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- Albert Mfg. Company
- Britnell & Company
- Ontario Lime Co., Ltd.

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- Pilkington Bros.

(Continued on page 18)

24 Milburn Lights

Purchased by the Canadian Government for use in the Hudson Bay District.

This is just another proof of the supremacy of Milburn Lights. Wherever reliability is required Milburn Lights are chosen.

Made in different styles and sizes to suit various requirements. Easily detachable and most economical. Costs only a few cents per hour.

Send for Catalogue

The Canadian Fairbanks-Morse Co., Limited

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Quebec Ottawa Regina Edmonton
St. John Hamilton Saskatoon Vancouver
Ft. William Victoria

Canada's Departmental House for Mechanical Goods

Storage Bins, Capacity 2000 Tons

Crushed Stone

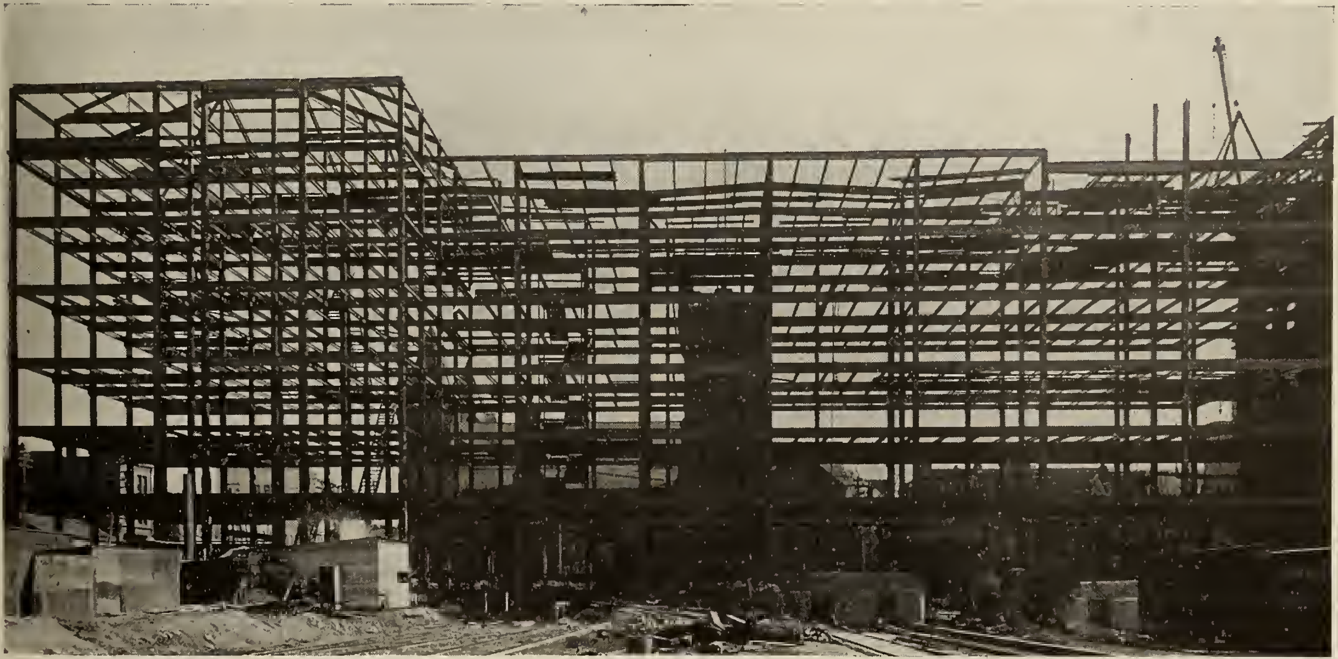
All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario



Section of Canadian Pacific Railway Terminals, TORONTO

Structural Steel painted with "SUPERIOR GRAPHITE PAINT"

WHY?

Because Architects and Engineers know it's "A LITTLE BETTER"

DOMINION PAINT WORKS, Limited
WALKERVILLE, ONT.

TORONTO
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Canadian Buffalo Forge Co.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Canadian Sirocco Co.
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Gray Mfg. & Machine Co.
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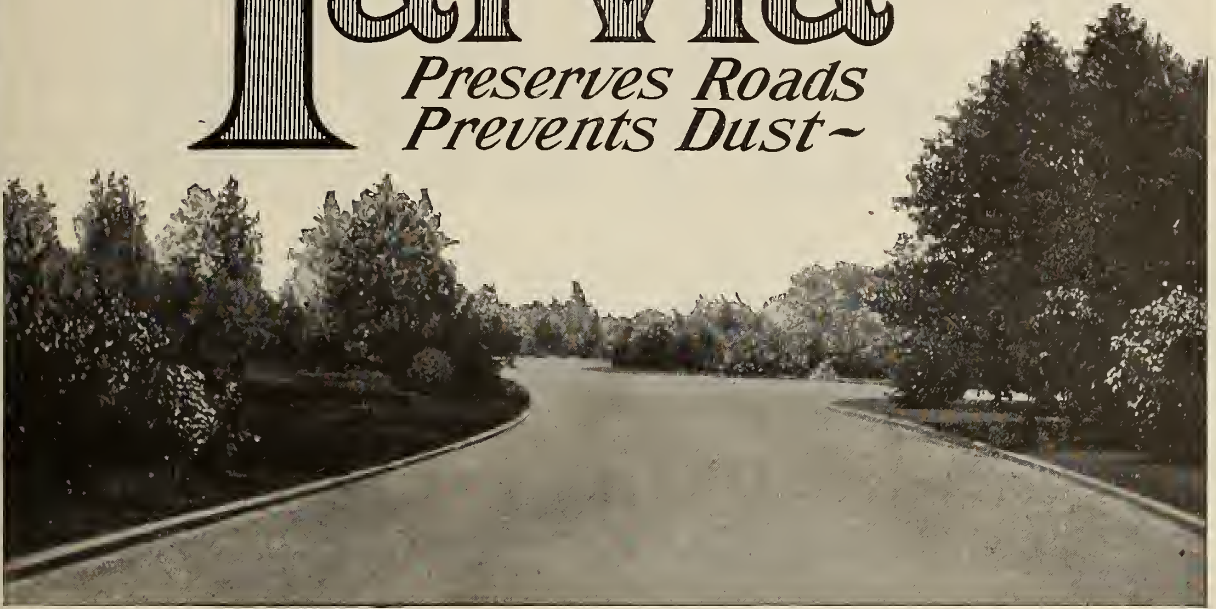

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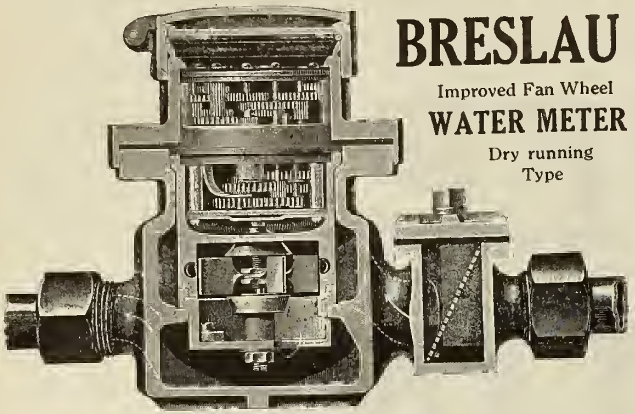

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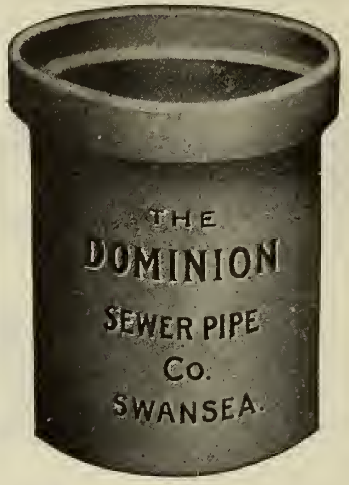

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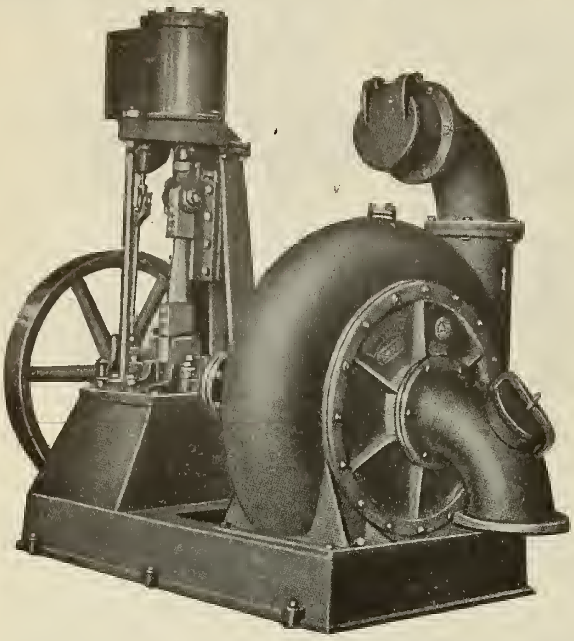

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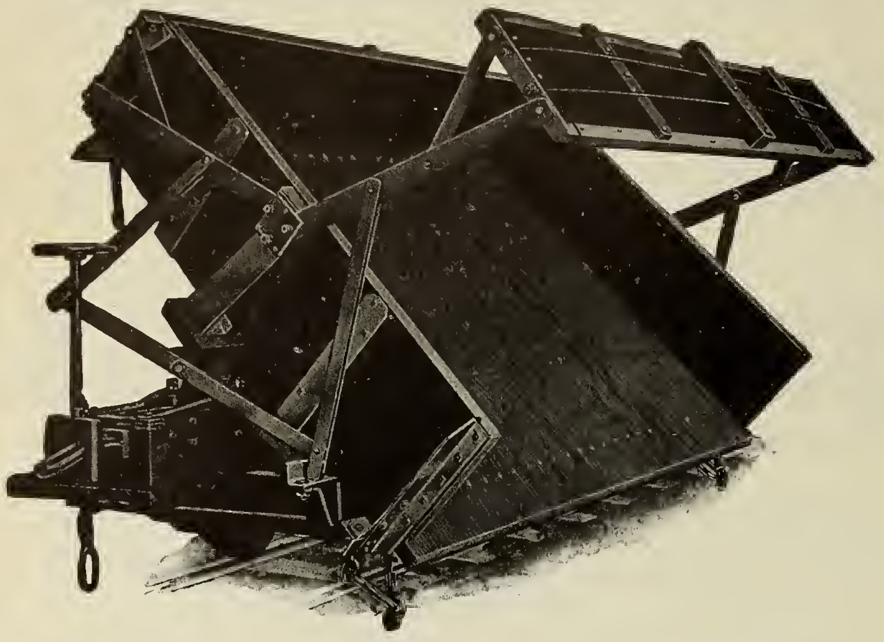

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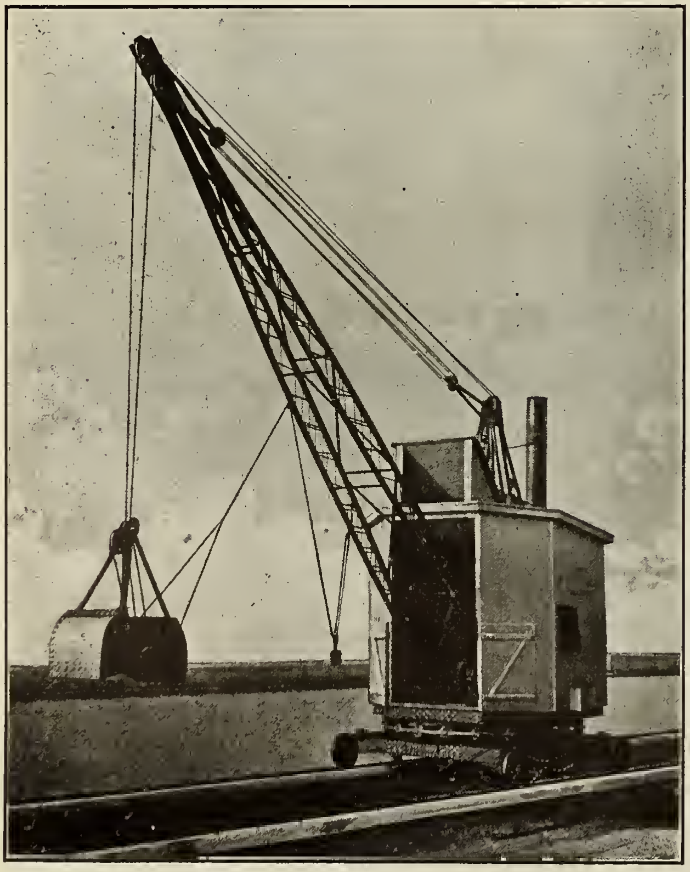

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R. Hamilton & Company, Vancouver, B. C.
H. W. Petrie, Limited, Toronto
E. Leonard & Sons, St. John, N. B.
A. R. Williams Machinery Company, Winnipeg, Man.

KAHN SYSTEM

OF REINFORCED CONCRETE

Steel Sash

Hyrib

Rib Bars

Rib Metal

KAHN SYSTEM Reinforced Concrete

Concrete Finishes

Water-proofing Pastes

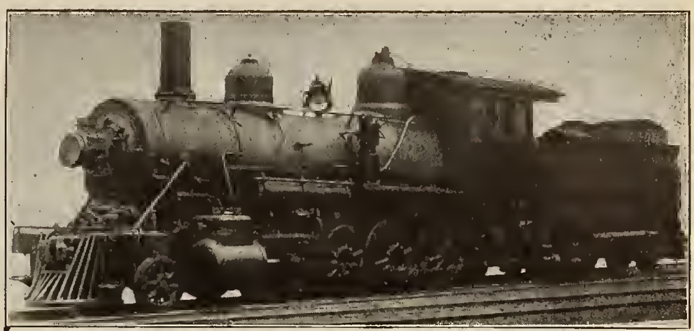
STEEL FLORETYLE

FOR LONG SPAN CONSTRUCTION

Trussed Concrete Steel Co. of Canada Limited

Head Offices and Works: Walkerville, Ont.

Branches Everywhere



Central Locomotive & Car Works

Largest Rebuilders of Railroad and Contractors equipment in America. Operate Two Extensive plants near Chicago. Have filled Large Orders of Equipment for Canadian Contractors.

We carry in stock **Locomotives of all types, Flat Cars, Center, Side** and **Air Dump Cars, Box** and **Gondola Cars.** Can make Prompt Deliveries. Prices Low.

Write for Specifications and Quotations on anything you need.

Central Locomotive & Car Works

410 Fisher Building Dept. S

Chicago, Ill.

$45. GARROW

Contractors Acetylene Flare Light

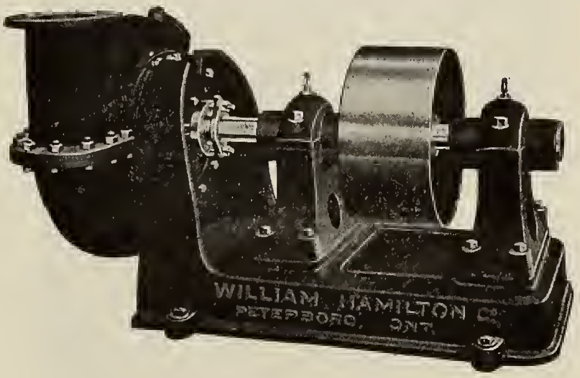
The great feature of this new light is strength and simplicity. The light is constructed of steel assembled by the Oxyacetylene Welding Process and consists of three parts. It is made to stand the roughest handling by unskilled labor without injury. A distinct advantage of the Garrow Light is its use in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame.

$45.00 F. O. B. Sudbury

The

Sudbury Construction & Machinery Co., Ltd.

Sudbury, Ont.



Contractors' Pumps

These pumps have been specially designed for contractors' use. They are made for belt, direct engine or motor drive.

They have special features not found in any other pumps, notably the horizontally split shell and the wide spacing between pulley and bearings.

They are built in all sizes from 2-in. to 14-in. discharge.

Ask for pump bulletin.

William Hamilton Company

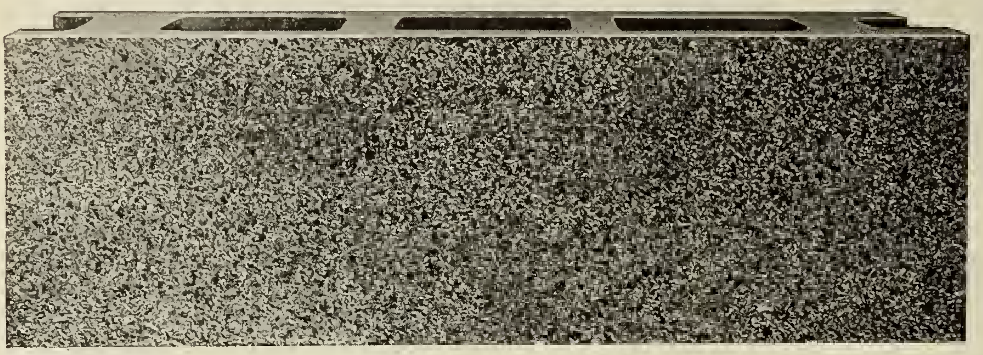
Peterborough, Ontario

Zagelmeyer System

OF CASTING

Hollow Cement Building Blocks

With Granite Faces



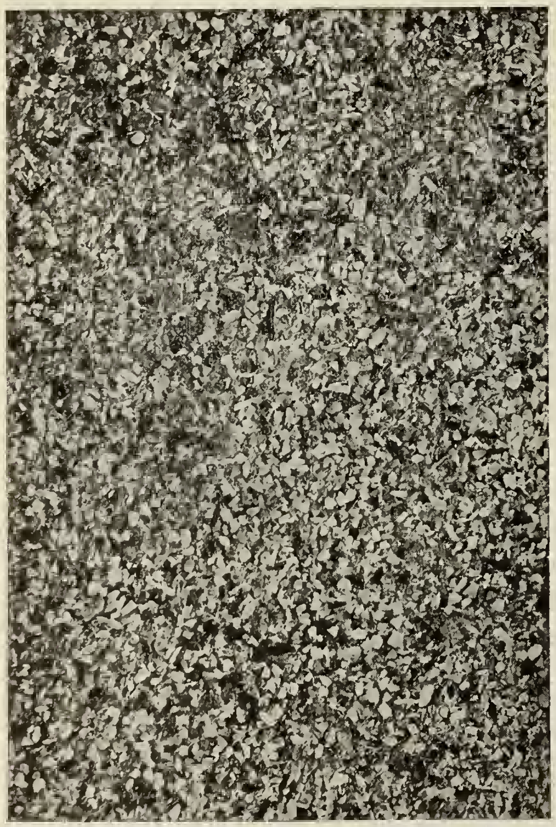
They cost less

They sell for more

You sell more of them

8 x 8 x 24 inch Granite Smooth Face Block

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



Enlarged View of Granite Smooth Facing

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold or moisture.

8 x 8 x 24 inch Granite Rock Face Block

Send us fifty cents and we will send, freight prepaid, to any point in Ontario, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

MR. BLOCK MAKER:—

What show will you have if your competitor secures the exclusive right for this system in your city?

MR. CONTRACTOR:—

Get into a business that is protected. Then you will make money.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Canadian Zagelmeyer Co.

Limited

298 Howard Ave., Windsor, Ontario

Blast Hole Drillers

Shoot the Whole Face—Not by "Benches"

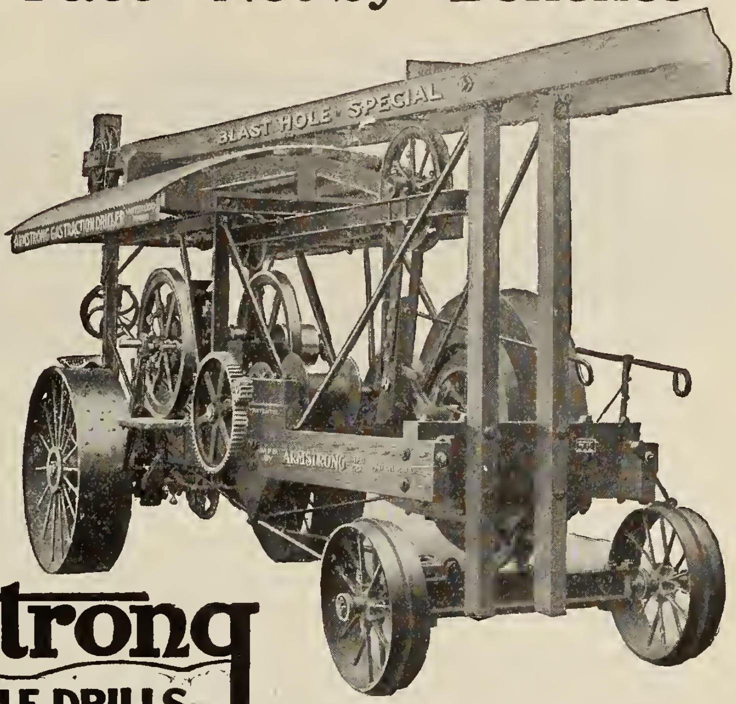
Break up the rock for easier handling.

Cut down the cost of powder per ton of rock.

Stop your shovel and crew *once,* not a half dozen times.

Save on your track laying expense.

Reduce the liability of damage and accident.



Armstrong
BLAST HOLE DRILLS
BUILT FOR SERVICE SINCE 1867

Shooting the Whole Face

One Shot

We guarantee the Special "Armstrong Blast Hole Drill" to drill more footage in a given time than any other cable drill.

We have data on six months' tests where, in competition, it proved 53% more efficient.

It is interesting and valuable.

Write Now for Bulletin S.
It Tells How!

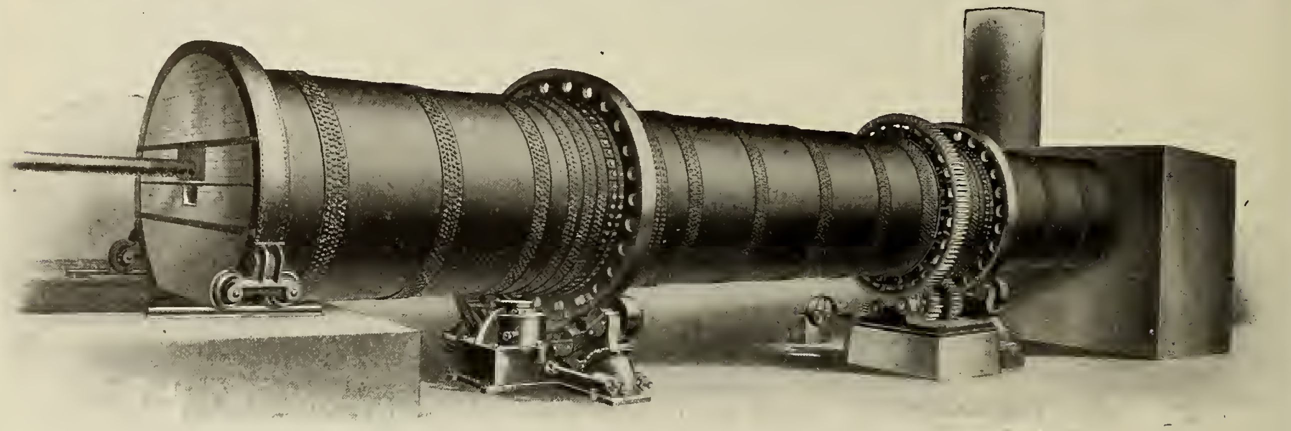
Armstrong
MFG. CO. WATERLOO, IOWA. U.S.A
BUILT FOR SERVICE
SINCE 1867

Eastern and Export Office:
17 Battery Place, New York City

Western Branch:
3rd and San Pedro Sts., Los Angeles, Cal.

Canadian Branch:
Drinkle Block No. 2,
Saskatoon, Sask.

Modern Cement Making Machinery



Kennedy Rotary Kiln, equipped with Ball-Socket Self Aligning Bearings

If you are interested in Rotary Kilns:

This cut represents the last word in Kiln construction, ball and socket self aligning cradle bearings, automatic oiling system for gears, extra heavy gear bases, extra heavy tires, in short, a 1914 Kiln.

We have representatives in every part of Canada. May we have one of them call and explain why this kiln runs 50% easier than other well known makes, which means 50% less power, and 50% longer life, or write for full particulars.

A foreign representative of a large cement manufacturing concern, after visiting many of the larger cement plants in Canada and the United States, stated that there was not a kiln manufactured in Germany or the United States that was a good second to the Kennedy Kiln.

Complete line of Kennedy heavy duty machinery, including,

Gyratory, Roll Hammer and Jaw Crushers
Revolving and Pulsating Screens
Tube Mills, Etc.

F J A B Rock Drill Steel

Hollow or Solid **Reliable and Economical**

SEND US A TRIAL ORDER

Rock & Power Machinery

Limited

Exclusive Agency in Canada for the Kennedy Manufacturing and Engineering Co.

HEAD OFFICE: 12 King Street East, Toronto, Ont.

BRANCH OFFICES: Vancouver; Sudbury; Montreal; Cobalt; Halifax;
and in the King Edward Hotel, Toronto

Hull Iron & Steel Foundries, Limited

HULL, - QUEBEC

Manufacturers of

"Adamantine," Chrome and Manganese Steel Castings

(Annealed and Unannealed)

TRADE MARK

IF ITS CASTINGS WRITE TO US · ADAMANTINE MANGANESE STEEL

Machine - Moulded Gears up to 16 feet. Grey Iron, Semi-Steel, Brass Bronze and Aluminum Castings.

Cement Mill Machinery

Our Specialty

- Tube Mill Feeders
- Griffin Mill Roll Heads
- Ball Mill Plates for Krupp Mills
- Kominuter Plates for Smidths Mills
- Steel Balls for Kominuters
- McCaslin Conveyer Wheels with "Coplan" Self-Lubricating Bushings
- Lining Plates for Bonnot Tube Mills
- Parts for Bonnot Pulverizers
- Screw Conveyer Bearings
- Eccentric Hubs, Crusher Heads and Concave Strips for Gates Crushers
- T. M. Revolving Feeders (new style) for Gates Tube Mills

Patterns for all these lines kept on hand.

We solicit your patronage and prompt attention will be given to tenders on above work.

Montreal Office, New Birks Bldg. Phone up-town 4069

YOU WANT CLEAN STONE WORK!

R. I. W. No. 110

Prevents Discoloration by Cement Mortar

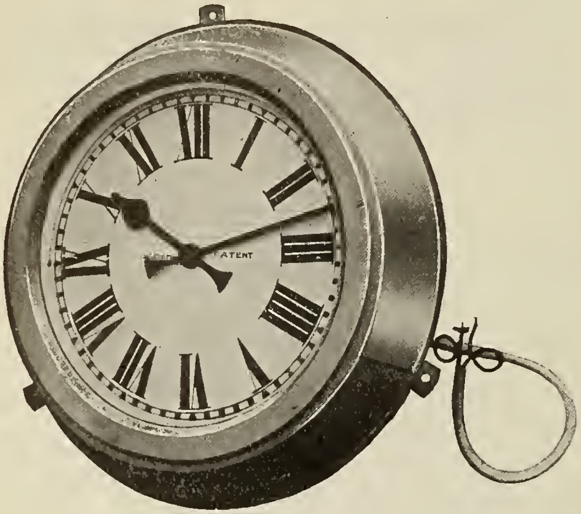
Write for

Specification for "Backing" Stone

"R. I. W." DAMP RESISTING PAINT CO.

Office: 202 Mail Building, Toronto (TOCH BROS.) Factory: Oakville, Ont.

ISTRIBUTORS—Black Building Supply Co., Limited, Toronto Western Paint Co., Winnipeg
Dartnell, Limited, Montreal Canadian Equipment & Supply Co., Limited, Calgary and Edmonton
Write nearest distributor for full information



What's the Time?

There would be no argument on this subject if the "PULSYNETIC" Electric Clocks were installed.

They are invariably correct because they depend on the unvarying force of gravity.

Accurate and uniform time is shown throughout any building in which they are installed.

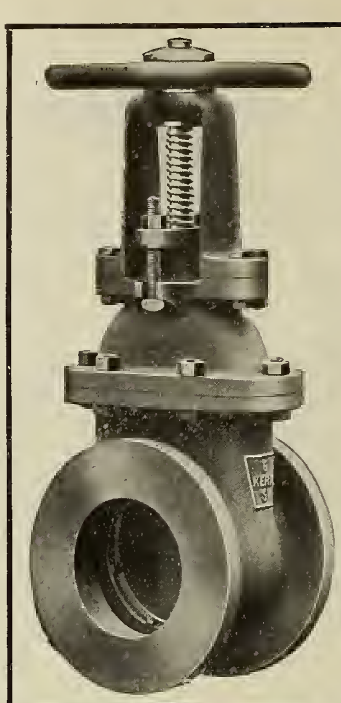
Easily fixed, no winding and no skilled attention is required.

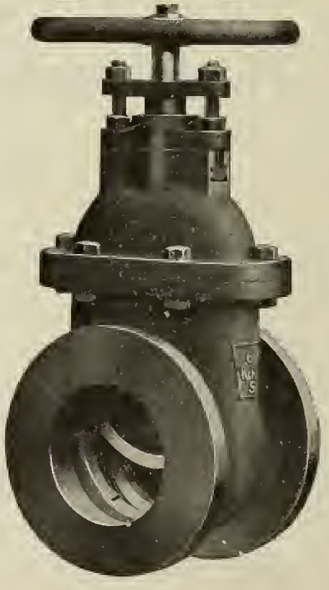
Send for Book No. 5

which contains fullest information about all classes of Electric Clocks.

GENT & CO., LTD.

Leicester, England





The KERR "Keystone" Iron Body GATE VALVES

are not surpassed by any other gate valve in **Design, Quality** of material, **Durability, Workmanship,** and up-to-the-minute requirements.

They have been designed and are built to meet the specifications of the most exacting and critical Engineers, and will bear the rigid scrutiny of "THE MAN WHO KNOWS."

If you are particular about the valves you specify or buy, you will not only **specify, but demand Kerr (Keystone) Iron Body Gate Valves.**

Any **Kerr Valve** lends class and distinction to any steam or water job.

Manufactured and Guaranteed by

The
KERR
Engine Company
Limited
WALKERVILLE, ONT.

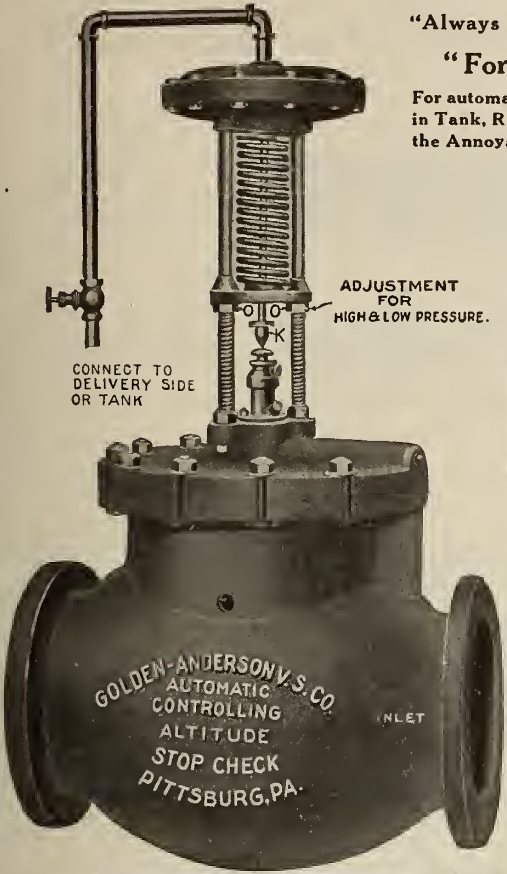
VALVES and HYDRANTS
exclusive output.

The Golden-Anderson Pat. Cushioned Controlling Altitude Valves

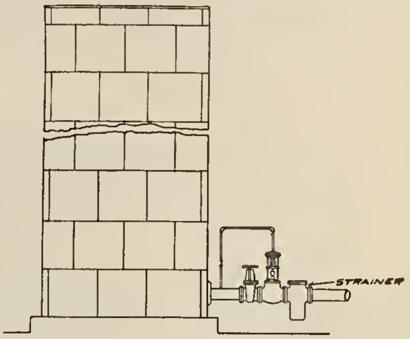
"Always Cushioned in Opening and Closing"

"For High and Low Pressure"

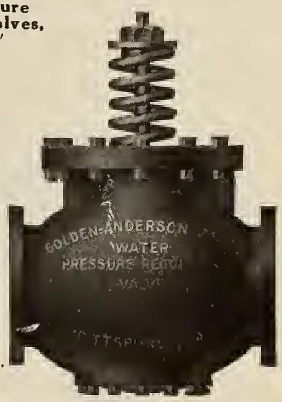
For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.



Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.



Automatic Cushioned Water Pressure Regulating Valves, up to 24"



Golden-Anderson Float Valves

(Angle or Straight Way), up to 24"

Golden-Anderson Valve Specialty Co., 1247 Fulton Bldg.
Pittsburgh, Pa.

When the Architect says "DOUGALL or as good"—he makes an Irish bull

Because he knows as well as you do that there is no other varnish as good as

Dougall Varnish

The Varnish That Lasts Longest

The Dougall Varnish Co., Limited, Montreal, Que.

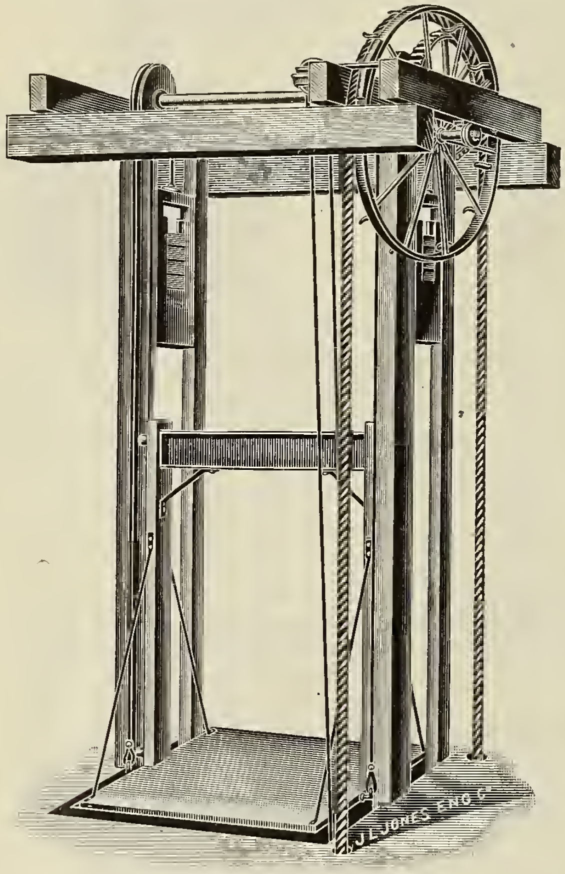
Associated with Murphy Varnish Co., U.S.A.

Canadian Billings & Spencer, Limited

B
TRADE MARK

Drop Forged Drift Pins
fit right and wear well.

Welland, Ontario


J.L. JONES ENG. CO.

Turnbull Elevators

Passenger
Freight
Hand Power
Dumb Waiters

The Turnbull Elevator Mfg. Co.
Toronto, Ont.

Sash Weights
and
Cast Washers

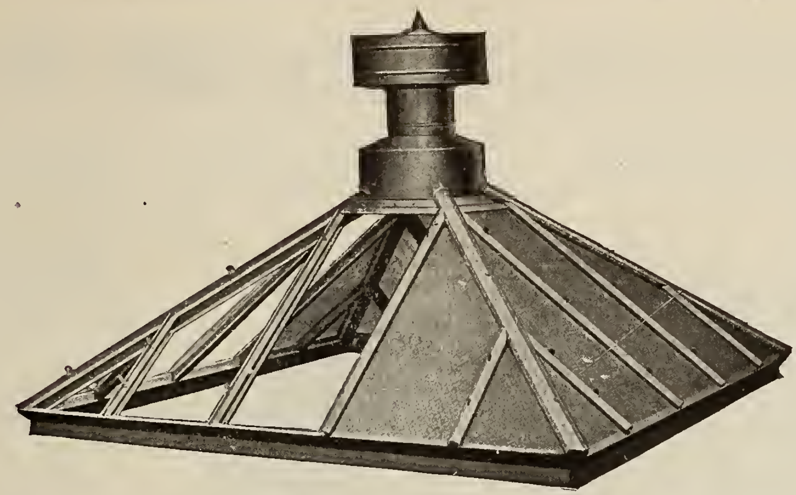
Manufactured by
Fittings, Limited, Oshawa
Montreal Winnipeg Vancouver

WELLS AND GRAY, LIMITED
Engineers and Contractors

Buildings and Construction Work
OF ALL KINDS
Reinforced Concrete a Specialty

Write us for preliminary plans,
estimates and photos of our work.

247 Confederation Life Building, TORONTO, ONT.



Pedlar's "Perfect" Skylights and Ventilators made from galvanized steel, TONCAN METAL or copper—All sizes and to suit any and all requirements. Our Skylights are **puttyless** and do not leak. Our ventilators have automatic closing attachment, made either metal or glass top.

Get our prices without fail.

The Pedlar People, Limited

OSHAWA, ONT.

Montreal Toronto Ottawa London Chatham Winnipeg

89-F

Architectural Sheet Metal Work — Everything in Sheet Metal for building.

Wooden Water Pipe

Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed. Prompt attention to inquiries.

Write for prices.

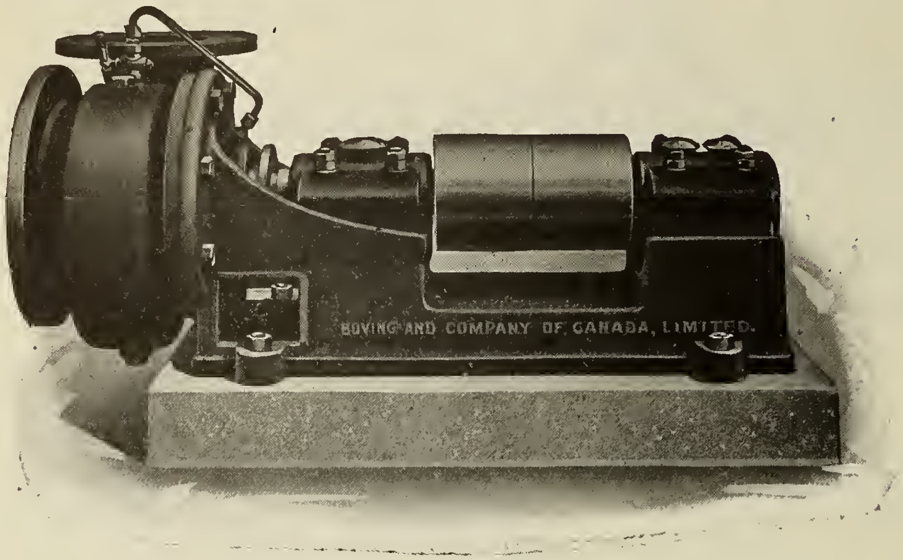
Manufactured by

Canadian Pipe Co., Limited

P.O. BOX 915

Factory: 550 Pacific St., VANCOUVER, B. C.

J.O.B. CONTRACTORS PUMPS



Belt Driven Low Pressure Pumps of Solid and Durable Design — Built for Heavy Duty.

Let Us Quote on Your Requirements

Pumps for all purposes
Belt Driven
Direct Connected
High, Medium and
Low Pressure

Illustration shows 10" Contractors Pump.

Boving & Co. of Canada Limited

Head Office: 164 Bay St., TORONTO **Works: LINDSAY, ONTARIO**
MOOSE JAW: 94 Grafton Ave. **VANCOUVER: London Bldg.**

Rosebery says:
"INTERNATIONAL" in the end—why not now?

Superior Construction

It spells longer life, less repairs, no breakdowns, constant service, greater output, and lower operating and mixing cost. On the next job use the

"INTERNATIONAL"

Concrete Mixers
GLOBE TYPE

Some New Improvements worth investigating:

Globe Drum, Steel Tracker Bands, Self Oiling Winding Drum and Tracker Wheels, Steel Chain Drive

Write to-day for complete Catalog No. 60-98 and prices.

Large stock carried for immediate delivery

Power & Mining Machinery Co.

MILWAUKEE, Wis., U.S.A. ***Factory:* Cudahy, Wis.**

10 sizes, 4 to 100 cu. ft. per batch. Any power.
Agents wanted in open territory. M325.4

"I am satisfied that it will effectually prevent seepage of moisture."

CERESIT

TRADE MARK

The Dependable Waterproofer for Cement

Read the letter on the right. It's interesting.

Y.M.C.A. Norfolk, Neb.

Norfolk, Neb., February 10th, 1914.

CERESIT WATERPROOFING CO.

Dear Sirs: Your letter of recent date, asking that I give you my opinion of your "Ceresit Waterproofing" which we used in the construction of the Y. M. C. A. swimming pool at this place, has been received.

Our pool is of reinforced concrete construction with a plaster coat of cement mortar about one and one-fourth inches thick in which we used between 15 and 18 lbs. of the waterproofing for each 100 square feet of plastered surface.

With the exception of a little moisture around the intake and outlet pipes, which could not be attributed to any failure of the waterproofing, the other walls of the pool are perfectly dry at the end of a ten day test, during all of which time the pool was full of water.

I am satisfied from our experience with this material, that, if the proper amount is used in accordance with instructions it will effectually prevent seepage of moisture.

Respectfully yours. E. M. Huntington,
Member of Building Committee, Young Men's Christian Association.

Use Ceresit wherever conditions of dampness or water-pressure obtain. Its method of use is simple — its results sure and permanent. Write for the new 1914 "Book of Evidence" which tell all about Ceresit.

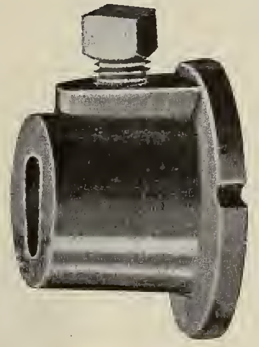
Ceresit Waterproofing Company

913 Westminster Building, CHICAGO, ILL.

FACTORIES: Chicago, Unna, Germany; London. Paris. Vienna, Warsaw

LIST OF DEALERS—W. B. Poucher, Edmonton, Alta.; E. G. Cullen, Vancouver, B.C.; Walkers, Ltd., Winnipeg, Man.; R. de B. Carrite, St. John, N.B.; W K. Macdonald Co., Toronto, Ont.; McLellan Peters Co., 305 Read Bldg., Montreal; The Whitlock-Riddell Co., Moose Jaw, Sask.; MacKenzie & Thayer, Ltd., Saskatoon, Sask.; N. G. DeHaas, Sault St. Marie, Ont.

Universal Form Clamp



Secured to the ends of round rods passed through your forms, these inexpensive clamps hold the centering rigid, resisting a strain exceeding the tensile strength of the steel rods themselves.

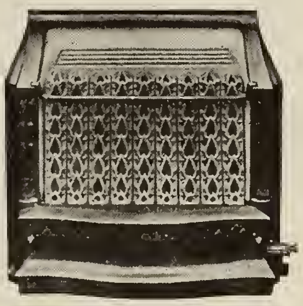
Clamps are easily applied, adjusted and tightened. A wrench releases them. Pull the rods out of the concrete with our Rod Puller.

Write today for Circulars and Prices

Railway Contractors Supply Co.

Standard Bank Building, Toronto

Agents for Ontario and Eastern Canada



Hygienic Solution of the Residence Heating Question

For years "Gas Fires" have been regarded as experiments. Later Experiments in Chemical Laboratories by Scientists, however, have brought "Gas Fires" out of this stage and placed them on the market as practical gas appliances, also as a perfect means of domestic heating. The design of the burners has received special attention, until now it is possible to obtain "Gas Fires" that give perfect combustion. The new grates are very attractive in appearance. The illustration shown herewith being an example of one of the new designs. **55 per cent. of the total B.T.U.'s in the gas is given out as Radiant Heat.** 25 per cent. of the remaining B.T.U.'s is given off as convected heat. The balance is used in creating a draught in the flue, removing the products of combustion, and thus also assisting in proper ventilation of the apartment. Full information on request.

The Consumers' Gas Co.

12-14 Adelaide St. W. TORONTO

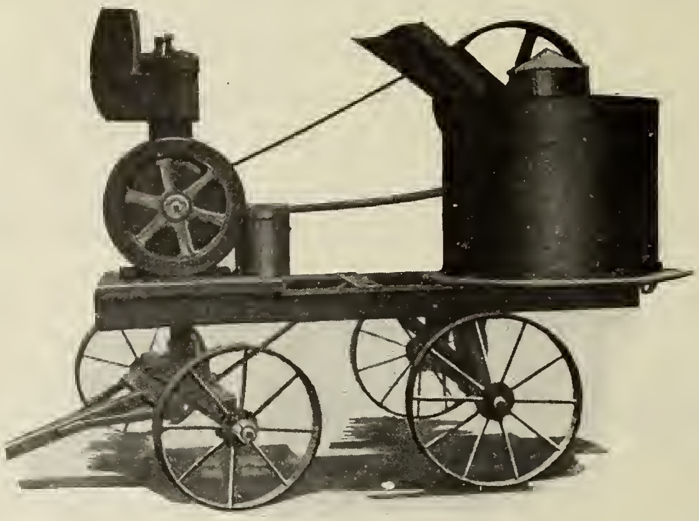
To Active Contractors:

48 Patented Harding Mortar Mixers Free

For quick distribution to get this PLASTER and MORTAR Mixer into successful operation in all sections of Canada. All that we ask you to do is to buy the engine and truck at the regular market price. We do this because every mixer yet sold has sold from 3 to 6 others therefore we can afford to lose on these 48. Write or wire now for particulars regarding this unusual proposition. **Only the first 48 Active Contractors get in.**

(In writing to any of the users enclose stamp for reply)

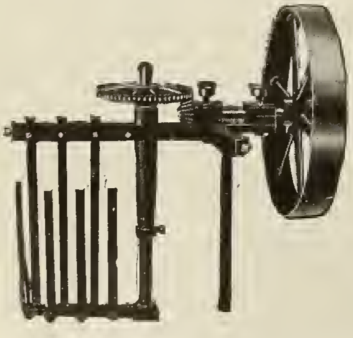
Gentlemen,—It's the best proposition I ever saw. It's what I'm telling everyone who asks me about your Mixer. It sure mixes hard wall to perfection. It paid for itself on the first job. I want another mixer soon with 2½ h.p. engine also. It will save me one-quarter of my material bills.—Signed, T. F. Egglestein, Cedar Rapids, Iowa.



The machine as it is now being shipped ready to be backed up to your mortar box and commence dropping mortar

Specifications of the FREE MIXER:—

Thirty inch Mixer, capacity about 300 sacks a day, mixing enough to keep 25 plasterers or 50 masons busy. Drum 30-in. x 24-in. deep. ¾-inch square tool steel mixing rods; steel cut gears, completely covered; apron, spliced truck six feet in length; equipped with 2½, 3 or 3½ h.p. engine.



Showing Inside Simplicity of Construction

The bottom scraper keeps the bottom clean, the side scraper the sides. Nothing to wear out or give trouble.

New Liskeard, Ont.

Gentlemen,—We take pleasure in advising that your mixer is giving perfect satisfaction. The only trouble we have had so far is the breaking of one of the steel rods. Signed,—HILL, CLARK, FRANCIS, Ltd.

Friend Contractor—

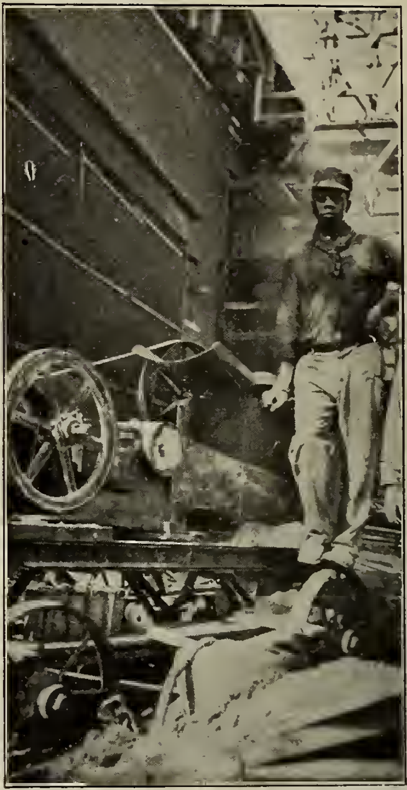
Better write or wire for particulars on this proposition now rather than regret later that you did not. Only the first 48 contractors will get this mixer free. Act NOW.

Mortar Mixer Corporation

Iowa City, Iowa, U. S. A.

Agents and Dealers wanted. Many valuable territories yet open.

Will prove to be a big winner in your territory.



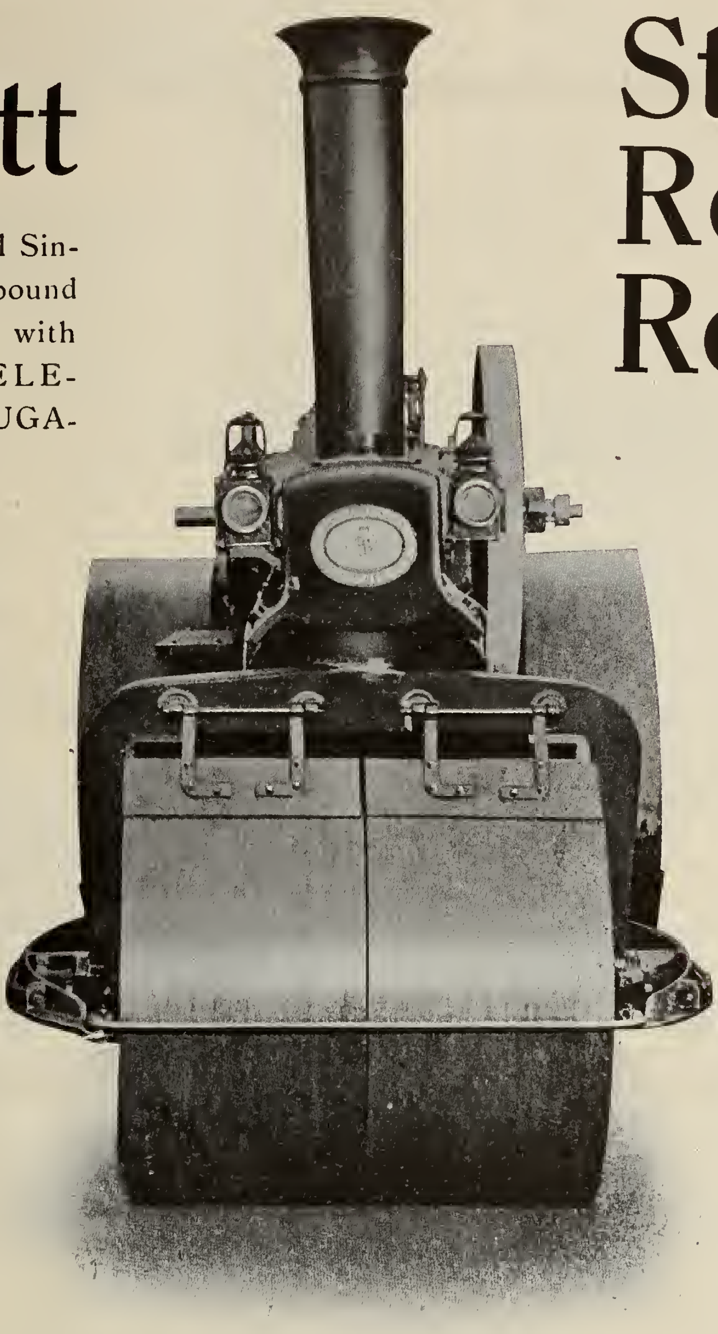
Mixed Portland Cement on this Des Moines Job

Gentlemen,—Enclosed find cheque for balance due on mixer. Have had the mixer in use for about six days and find that it will do all that you claim for it, and we feel that we can recommend the same to anyone who wishes a machine of this kind. Signed,—KOTO & PERRY, Forest City, Iowa.

The Garrett Steam Road Rollers

The BOILERS of all Single Cylinder and Compound Rollers are fitted with GARRETT'S CELEBRATED CORRUGATED FIREBOX of exceptional durability, whereby an important economy in fuel consumption is effected and the steaming capacity of the boiler is increased, rendering our Rollers unsurpassed for rolling up steep gradients.

The steam working pressure of Single-Cylinder Rollers is 140 lbs. per square inch and of Compound Rollers 160 lbs. per square inch.



Single Cylinder and Compound—Sizes 6-20 Tons
also made Combined Road Roller and
Traction Engine

WRITE FOR CATALOGUE

The following OUTFIT is provided with all our Rollers, Single-Cylinder and Compound.

Waterproof cover of best Willesden cloth, one pair large head lamps, tail lamp with red and white sliding shutters, water-gauge lamp for night work, toolbox with all necessary spanners, hammer, caulking tool, oil can, fire irons, tube brush, set of frost pegs for hind rollers, etc., etc.

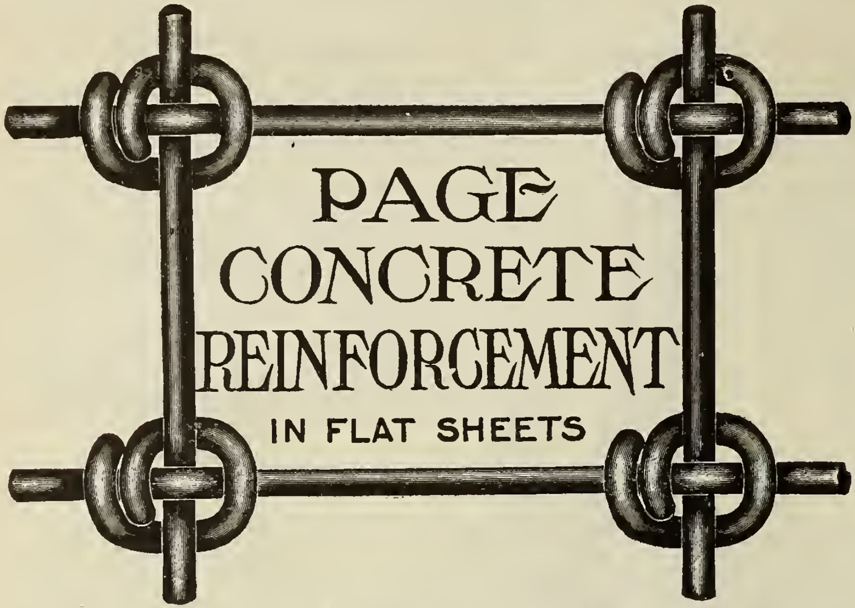
Richard Garrett & Sons, Limited, England

Address all inquiries to our Canadian Representatives :

BRITISH MANUFACTURERS'
ASSOCIATION OF CANADA, LIMITED
803 McGill Building, Montreal

Sole Agents in Canada for :

"National" Gas Engines, Gold Medal Suction Gas Plants
Adams & Co., "Boa" Cleaning Waste
Geo. Shipman & Co., High-speed Steel
Rochdale Asbestos Co., Limited, Packings, Etc.



Can be supplied in rolls if preferred.

PAGE Concrete Wire Reinforcement

for Concrete Road Pavement, Bridge and Building Floors

We are the originators of this wire reinforcement in flat sheets, and it is coming into universal use wherever introduced. We have supplied many carloads of it this season.

The standard mesh for road pavement is 6 x 12 inches; for bridges and building floors, the standard is 3 x 6 inches. All sheets 4 feet wide, and any length specified that can be loaded in cars.

PRICES per 100 sq. ft. delivered—6 x 12 mesh $0.75—3 x 6 mesh $2.25

Samples will be sent upon request.

The Page Wire Fence Company, Ltd., **Walkerville Ontario**

Branches:— Toronto Montreal St. John, N. B.

Three Thousand Tests on Rail Steel Reinforcing Bars Prove Their Merit

The American Society for Testing Materials appointed a Committee to investigate the merits of rail steel reinforcing bars.

Upon 2,036 samples, 2,983 tests were made. Prof. W. K. Hatt, of Purdue University, who directed the collection of samples from six mills at unexpected times, and who made the tests, reported as follows:

1—The rail steel showed **an excess ductility for its strength** above the usual grades of steel.

2—The material **showed remarkable uniformity** as 80% of the bars did not vary more than 12% from the mean tensile strength. There was no data available showing the variability of high carbon billet steel with which this could be compared.

3—The process of manufacture had **raised the mechanical quality** of the material.

These tests merely corroborated the testimony that has been given in a practical way on hundreds of big engineering-contracting jobs. In Canada such well-known work as the Wasdell Falls Dam of the Ontario Hydro-Electric Power Commission, the C. P. R. Elevator at Port McNicoll, the G. T. P. Elevator at Fort William, the Maple Leaf Milling Co. Elevator, the Canadian Westinghouse plant. Section 2 of the Welland Canal, Elevators No. 1 and No. 2 for the Montreal Harbor Commission, etc., etc., have been constructed with

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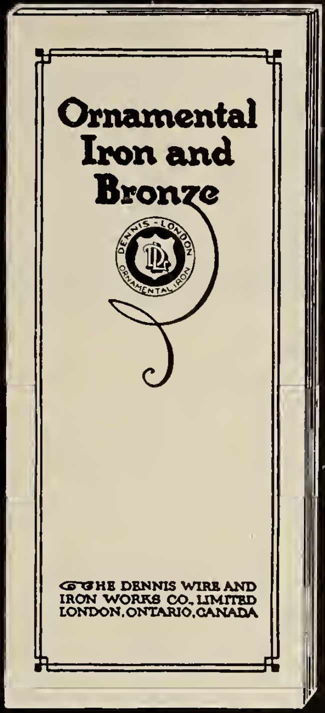
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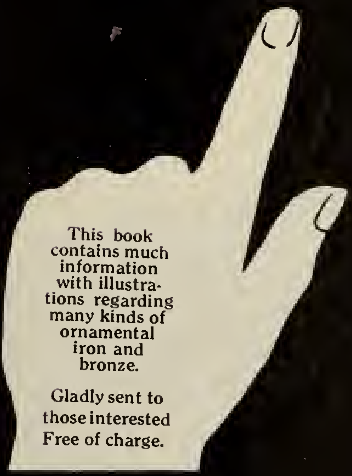

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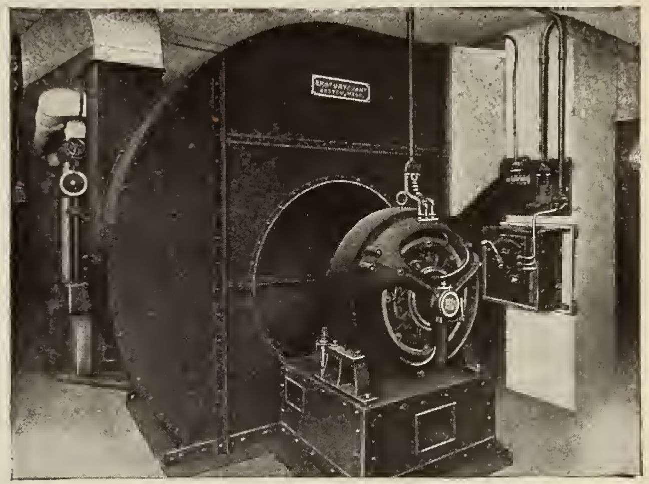

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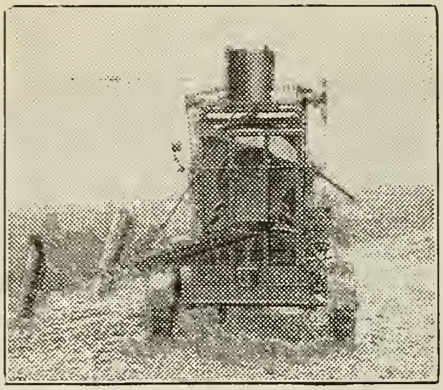

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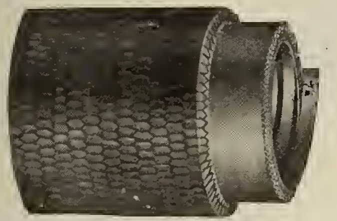

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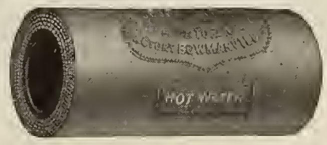

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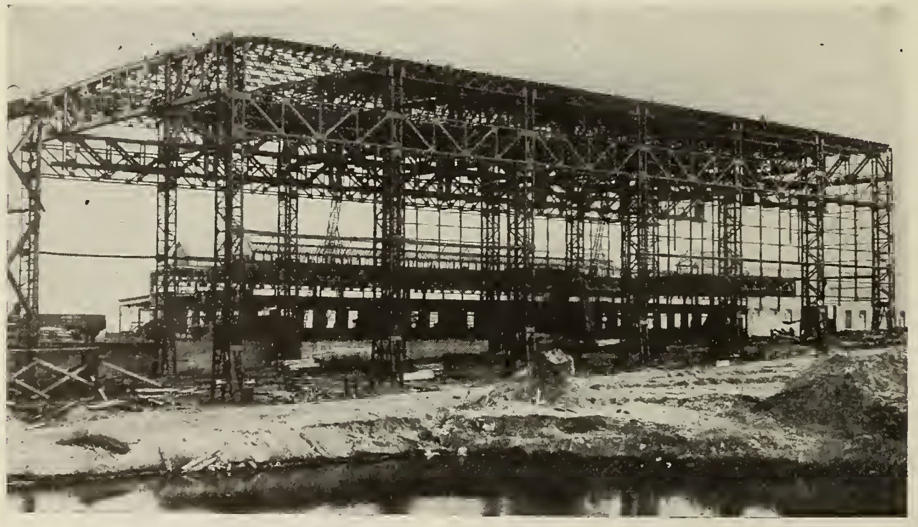

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Preference—A Misnomer

WHAT'S the matter with Vancouver's civic administration? In the light of recent developments one is justified in putting the query. Last week we discussed the unsavory conduct of a competition arranged by the local authorities; this week we desire to call attention to a matter of policy which has a far wider aspect.

In British Columbia there has been started a movement which has for its goal the encouragement and support of local industries by giving them a preference in trade, especially in the matter of material for public works and municipal supplies. Superficially and sentimentally such a policy might appear to be a good one, but when open competition is advertised it is impracticable in effect—that is to say it is impracticable if the competition is to be conducted on sound business principles. We are reminded of the matter very forcibly by an account of a recent meeting of the Vancouver City Council, when by the deciding vote of the Mayor the contract for a supply of valves for the waterworks department was awarded to a local firm, notwithstanding the fact that their bid was 22 per cent. higher than that of a United States competitor. To the credit of a faction in the council be it said that there was strong opposition to the award of the contract to a higher tenderer, the vote resulting in a tie which was decided by the Mayor. As far as our sympathies go, and as far as our patriotism is concerned, we believe that we could out-Vancouver any municipal council in British Columbia, but in a matter of this kind where reputation is at stake, and where honesty of business principle is concerned, preference, patriotism, sentiment, and so on are cheap substitutes for a glaring injustice. If the city of Vancouver or any other local body believe it to be in their best interests to confine competition to a coterie of their local supporters let them do it—but not under the guise of open competition. To go through the farce of calling for tenders and award a contract at a figure 22 per cent. higher than the lowest bid is an abomination of municipal practice which cannot be defended on the ground of "B. C. for British Columbians," "Canada for Canadians" or any other such delusive patriotism.

Canada is a young country, but she has already been imposed upon to the limit in the matter of local sentiment. Too often there have been ulterior motives behind the apparently patriotic actions of councils and other bodies in passing over outsiders. Brown has an interest in a brick plant, Jones' son is identified with an iron works, Smith has a remote connection with some other line of supplies, and so throughout the greater part of the council there is a laudable desire to promote home industries. Protection of home industries! What about the home industry of the ratepayer who has to foot the bill at 22 per cent. higher? He has a home industry whose interests are betrayed by such procedure.

On more than one occasion we have advocated the desirability of enabling the governing authority to use its discretion in the matter of the lowest bid, but we have had in mind only constructional work, where a man of insufficient financial backing or inadequate experience might be entrusted with a responsible public enterprise the failure of which would bring about great inconvenience and delay. That sort of thing is a far cry from a contract for a supply of valves, the requirements of which could be specified to a hair. When tendering on a building or some municipal undertaking, such as a waterworks or sewerage system, there are a dozen ways of omission and commission in which a contractor can make a bad blunder. Having discovered this a corporation might be well advised to pass over the bid, using its discretion in the matter of the deposit cheque. That is a different story.

It is not the first time we have had to direct attention to the evils of local preference. If preference of any kind is to be shown surely it should be set forth in the invitation to tender. Is it conceivable that any contractor would take the trouble to make up a tender if he knew that he was under a handicap of twenty or twenty-five per cent.? Then why rob him of the time and labor involved in preparing his bid? The policy of local or provincial preference as the Vancouver City Council understand it is a dishonest subterfuge for getting something for nothing and sooner or later it must re-act with dire results. **Under one condition only can preference be shown local industries and that is where all other things are equal**—which seldom happens.

We are told that there is a general campaign under way in Vancouver, and in the province generally, to create a sentiment in favor of purchasing British Columbia-made goods—even at a higher price than the imported article. In connection with the Second Narrows Bridge across Burrard Inlet, which is to cost approximately $2,000,000, it has been suggested that the specification of British Columbia manufactured steel and iron shall be compulsory. Further, the British Columbia Manufacturers' Association have adopted a label to be stamped on all goods manufactured in British Columbia—"in order," we are told somewhat facetiously, "to educate the public to ask for articles made in the province in preference to goods made in Eastern Canada or in foreign countries." In Eastern Canada or in foreign countries! When one thinks of the extent to which Vancouver and British Columbia—and in fact all Western Canada—have been dependent upon "foreign countries" (we include Eastern Canada) it makes one weep at the folly of the Coast Province.

Upon the wider question of the effect of such things upon the reputation and trade of the country at large we could say much, but we will not digress further. The corporation of Vancouver and the Provincial Government of British Columbia should come into the limelight with their policy. There are plenty of us in Eastern Canada and "other" foreign countries who desire to see Canadian industries flourishing, but it must not be, and it shall not be, at the expense of our national business reputation in Great Britain and the United States. Our best interests are bound up in the good-will of these countries—indeed, without British support our comparatively autonomous state could never have existed. Vancouver is not—fortunately—the hub of Canada, and British Columbia is not the whole of Canada.

During the last decade Canada has made many proud boasts—boasts capable of fulfilment only by strenuous devotion to honest enterprise. From one end of Canada to the other we want the enterprise that is engendered by competition. If we are to develop on bigger, broader and better lines we must have it. If we are to become self-centred in a state of mediocrity far removed from that destiny which many of us have pictured so fondly, we can dispense with it.

We would respectfully commend to the serious consideration of that enlightened city of British Columbia the well-worn but apparently ill-learned maxim, "Competition is the life of trade."

Construction and Production in Saskatchewan

Some interesting information regarding trade and constructional development in the Province of Saskatchewan is contained in the third Annual Report of the Bureau of Labor for 1913. While building permits for the cities of the province show a falling off in value from $23,564,561 in 1912 to $16,022,455 in 1913, yet the value of last year's buildings exceeds those of 1911 by nearly three million dollars. The report, dealing with Saskatchewan industries, states that despite the much-talked-of financial stringency during 1913 all the principal industries of the province show an increase in volume of business over 1912. Statistics regarding the manufacture of brick and tile show that the amount of capital, including plant, involved in the manufacture of brick in 1913 totalled $1,046,088, as against $314,796 in 1911. The plants in operation last year numbered eighteen, an increase of five on the two previous years, whilst the gross value of the product in 1913 is given as $594,630, compared with $187,824 in 1911. These returns from brick manufactures would tend to indicate the use of an increasing number of bricks of local or home manufacture for building operations from year to year

The report records the information that during 1912 Saskatchewan was the only province of the Dominion which showed an increase in the production of lumber over the cut of 1911, and that this increase was not less than 16.7 per cent. of the figures for the past three years. The value of lumber cut in 1911 was $2,266,435, being an increase of 77.5 per cent. and an average value per thousand feet, B.M., of $16.82. Lumber cut in 1912 represented in value $2,535,611, an increase of 16.7 per cent. and an average value of $16.12. The return for 1913, however, shows a falling off in the value of lumber cut to $1,908,482, or a decrease of 27 per cent. and an average value per thousand feet, B.M., of $16.62.

Regarding building operations the report has the following to say: "Whilst the total value of buildings erected in the cities of Moose Jaw, Regina, Saskatoon and Prince Albert is considerably less than in 1912, nevertheless it exceeds that of 1911 by nearly three million dollars. During the year 1913 two towns were added to the number of cities of the province with the result that the total value of buildings erected in the cities during 1913 was $17,159,950. To this might be added the building permits of Swift Current, which no doubt will incorporate as a city during the coming year, and it will then make a total value of buildings of $18,169,008."

Standard building-construction specifications issued by the National Fire Protection Association, Boston, are intended to establish requirements of construction suited to buildings of the greatest fire resistance. The principal items are incombustible material for all structural parts, ample space exits for all occupants, protection against exterior fires, provisions for confining interior fires to space in which it originates and installation of apparatus for extinguishing fire in its incipiency. Detailed specifications are given for service equipment, height, area, location and character of exits, allowable stresses, character of material and dimensions, construction and strength of walls, piers, columns, roofs, floors, stairs, shafts, partitions and wall openings.

The Various Types of Movable Bridges

A Comparison of the Many Modifications of Swing, Bascule, Direct-Lift, Pontoon and Transporter Bridges and Their Bearing Upon Transportation: Features of Design and Adaptability to Varying Conditions.

By W. M. Wilson*

PART I.

WITH the rapid increase in transportation and the accompanying congestion of traffic and increase in transportation facilities, one of the problems which is forcing itself more and more upon the attention of the engineer is that of providing transportation over navigable streams without interfering with navigation. This transportation has been provided for by the use of ferries, high overhead bridges, tunnels beneath the channels, and by movable bridges which when closed provide the traffic over the streams, but which can be opened as occasion demands, so as to provide a clear channel for the passage of vessels. The ferry at best is a makeshift and can be used only where the land traffic is light or where a bridge would be impracticable. Tunnels are expensive to construct and necessitate the use of heavy grades which are very objectionable. High overhead bridges with underneath clearance sufficient for the passage of the largest vessels, are limited in use, to localities where the street or track level is very much higher than the water level. A large majority of the crossings are equipped with movable bridges.

In order to meet the widely varying conditions governing the design of movable bridges for the various crossings, the engineer has exercised considerable ingenuity and a correspondingly large number of types of movable bridges are in use to-day. Mr. J. S. Langthorn in a paper on Types of Movable Bridges presented before the Brooklyn Engineers Club, April 14, 1904, gave the following classification:

"1. Swing Bridges, which revolve in a horizontal plane.

"2. Side folding bridges, which fold up in a horizontal plane.

"3. Bascule bridges, which revolve in a vertical plane and include the following:

(a) Trunnion bridges, which are revolved on horizontal shafts.

(b) Scherzer bridges, which open by rolling backwards and upwards on segmental girders.

(c) Miscellaneous types as the Harway avenue, Page, Schinke, Roll, Jack-Knife, or vertical folding, etc.

"4. Retractile bridges, or sliding draws which open in a horizontal plane and are mounted on wheeled trucks. The telescopic bridge at Queen's Ferry, England, is a modification of this type.

"5. Direct-lift bridges, which are simply large elevators.

"6. Pontoon or floating bridges, in which the channel pontoons may be moved for passing vessels. In some cases the pivot end is placed on the shore.

"7. Transporter bridges, in which a car hung from a high level truss travels back and forth between the banks of the waterway."

While there are many modifications of these various types, the only distinctly different type from those given above that the writer has seen described is one which rotates about a horizontal longitudinal axis.

The earliest moving bridges of which we have any record, were used for defensive rather than transportation purposes. These in general were bridges hinged at one end and lifted vertically by means of chains or cables fastened to the other end, or horizontal draw bridges in which the movable leaf was drawn back into the fixed approach span.

Of the early movable bridges used to provide for navigation the pontoon, or floating bridge, was very much in favor. These bridges were inexpensive and did not require for their construction the highly refined mechanical processes which are so essential to the successful manufacture of the newer types of movable bridges.

In the early days when land traffic was light and especially before the development of railroads which required that interruptions to traffic be reduced to a minimum, this type of bridge was very largely used. Its low initial cost and the ease with which it could be built without the use of elaborate equipment made it deservedly popular for pioneer road building in communities where funds were scarce and contractor's equipment crude. A comparatively large number of the early movable bridges built were of this type. A number of them are still in use. In addition to the advantages claimed above for this type of movable bridges is the advantage common to all pontoon bridges—since they require no foundations they can be built over streams whose beds are so soft that the support of a bridge on a pier is impossible. This has led to the use of pontoon bridges with pontoon draw spans over various rivers of India. Probably the most notable of these is the one over the Hoogly which connects Calcutta with Howrah. A number of bridges of the same type have been built at this crossing only to be replaced when worn out by similar bridges. The last one was built in 1874. Designs are being considered for a new bridge at this point.

As the density of traffic increased, and especially with the adoption of fast railway schedules, the delays incident to the more or less cumbersome operation of the pontoon bridges became more serious. The new conditions were well met by the use of swing bridges, and for some time—in fact, up to and including the present time—a very large proportion of all the movable bridges built were of this type. Bridges with pivots at or near the centre necessitating the use of but little, if any, counterweight and with supports to carry the live load at the centre and both ends are of economical design, of simple construction, quick of operation, rigid in service, and would seem to be of ideal design. The large number of these bridges in use indicates that they are so considered.

Horizontal rolling or retractile bridges were used in crossing moats around castles as a protective measure, but they have never been very popular among modern engineers. The rolling back and forth of the heavy structure consumes a large amount of energy.

---

*Assistant Professor of Structural Engineering, University of Illinois.

It is difficult to provide a motion of the moving leaf which will enable it to clear the fixed approaches, and the live load must be carried on the moving leaf acting as a cantilever, which it is hard to do with a structure that can be moved horizontally. This type of bridge can be used for narrow channels and also for light temporary structures, but it has not been used much for large permanent bridges.

The last few years has brought about conditions which have made the swing bridge poorly adaptable to certain locations. Increase in water traffic, together with an increase in the size of boats, have made the centre pier, usually associated with swing bridges, very objectionable in narrow channels, and increased value of land and dock frontage has made them expensive because of the property which they damage. Because the width of the centre pier increases with the width of the bridge, it is not customary to have more than two tracks* on a single bridge, and as the bridges must be far enough apart to let the ends clear when the bridge is moving, the carrying of a large number of tracks over a channel at any point is impracticable, if not, in fact, impossible. These considerations have led to the development of the bascule bridge, which, while usually more expensive than the swing bridge, can be opened in a space no wider than its own width and which provides a clear channel with no obstruction at the centre. There are a number of types of bascule bridges all of which have a motion in the vertical plane which causes the centre of gravity of the moving parts to be stationary at the centre of rotation or to move in a horizontal line. If either one or the other of these two conditions is satisfied, the only work which it is necessary to do in moving the bridge is that required to overcome inertia, friction, and wind pressure.

While the earliest draw bridges built, those used to cross moats at the entrance to castles, were bascule bridges, they did not come into general use until the new London Bridge was completed in 1894. Since that time their use has become very common. It is interesting to note that while some of the modern types of bridges are generally supposed to be new inventions and some of them are patented, a number of them are described, at least in principle, in the Handbuch der Ingerieur-Wissensch, which was published in 1888.

Vertical lift bridges which are opened by lifting the moving leaf in a horizontal position so as to allow clearance for the passage of vessels underneath have been built from time to time during the last century. The very recent development of a number of new types of vertical lift bridges has led to their acceptance in a number of instances during the last one or two years. Their extended use in the future is quite probable.

As the width of channel required has increased, the weight of the moving leaf of the bascule bridge whose weight is carried as a cantilever has increased very rapidly, and the weight of the counterweight has increased a corresponding amount. This has caused a large increase in the trunnion loads and in the weight of structural steel required to support the moving leaf as well as in the counterweight which balances it. In the case of the vertical lift bridge, the effective arm of the counterweight is much greater than for the bascule, so that the counterweight is much lighter. The bridge is supported on four trunnions, instead of two, making a corresponding reduction in the load on each trunnion. The dead load as well as the live load is carried as a simple span, which is much more efficient than the cantilever of the bascule bridge. The live load is carried directly into the masonry and not through the trunnions. It is sometimes possible to convert a fixed span into a vertical lift span by adding the necessary lifting mechanism. These facts would seem to indicate that for long spans where the underneath clearance is not too great the vertical lift bridge has some advantages over the bascule bridge.

At some crossings the water traffic is very heavy and the land traffic is comparatively light. This combination of conditions occurring at a point where a

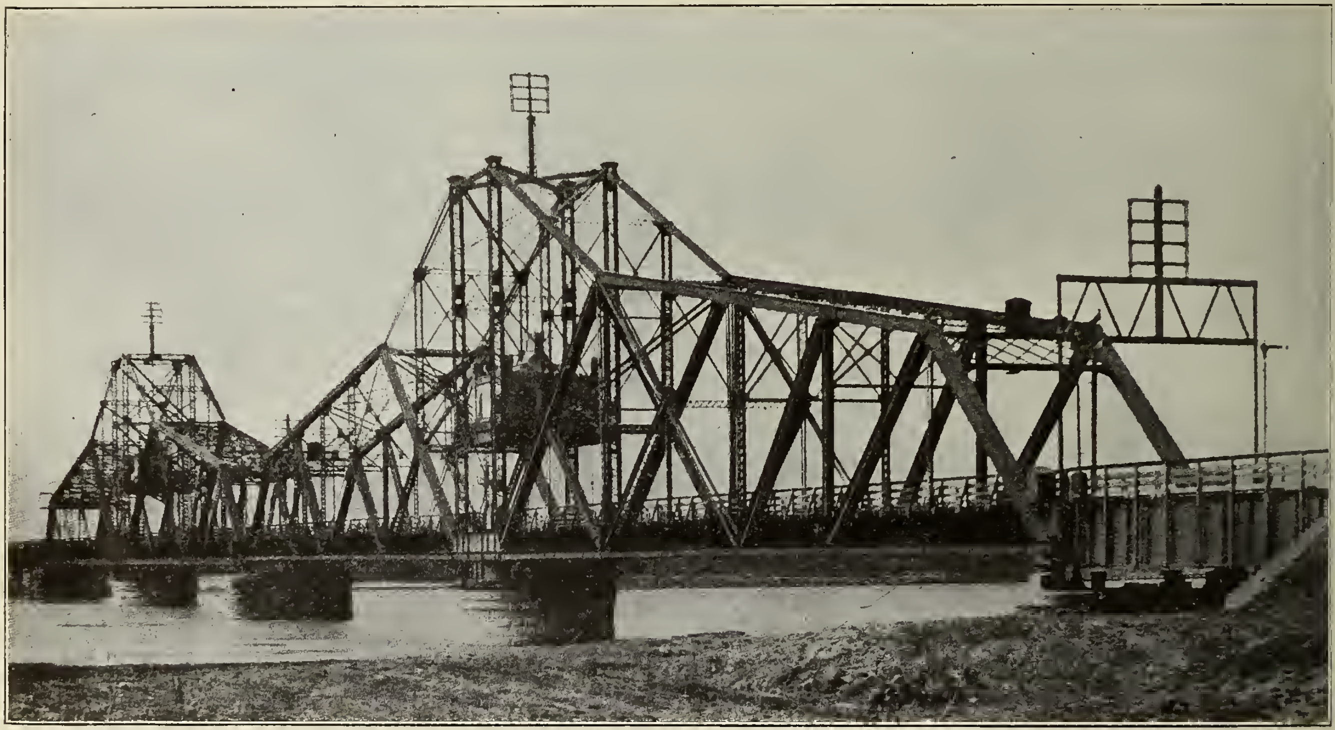


Fig. 1.—Two swing bridges over Missouri River at Omaha, Neb.

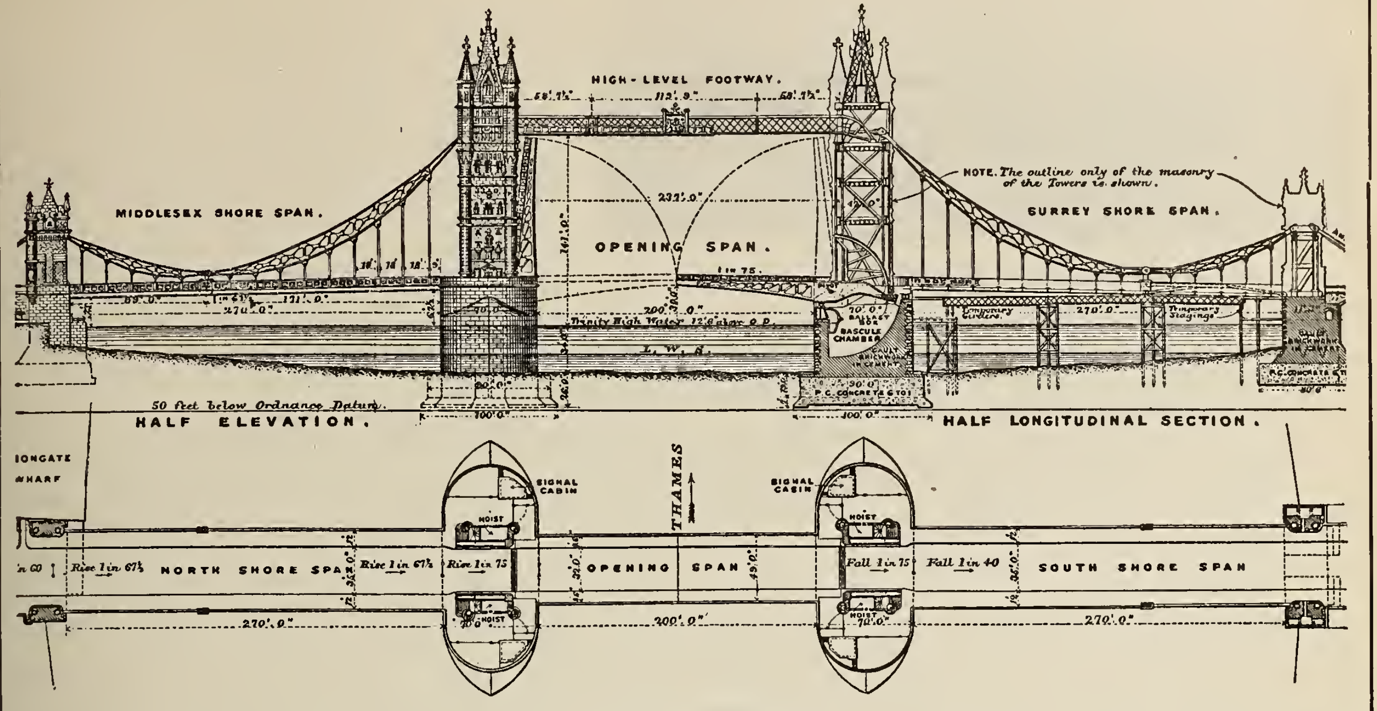


Fig. 2.—The Tower bridge, London.

The Various Types of Movable Bridges

Fig. 2 illustrates the general scheme of the bascule type. The draw span has a double-leaf bascule bridge supported on fixed trunnions and counter-balanced by counterweights. Each leaf is supported on four latticed girders. The distance, centre to centre of trunnions, is 206 ft. 6 in. Fig. 3 is the Scherzer rolling lift bridge, the first one of which was built in 1895. It consists of two leaves, each supported on two trusses.

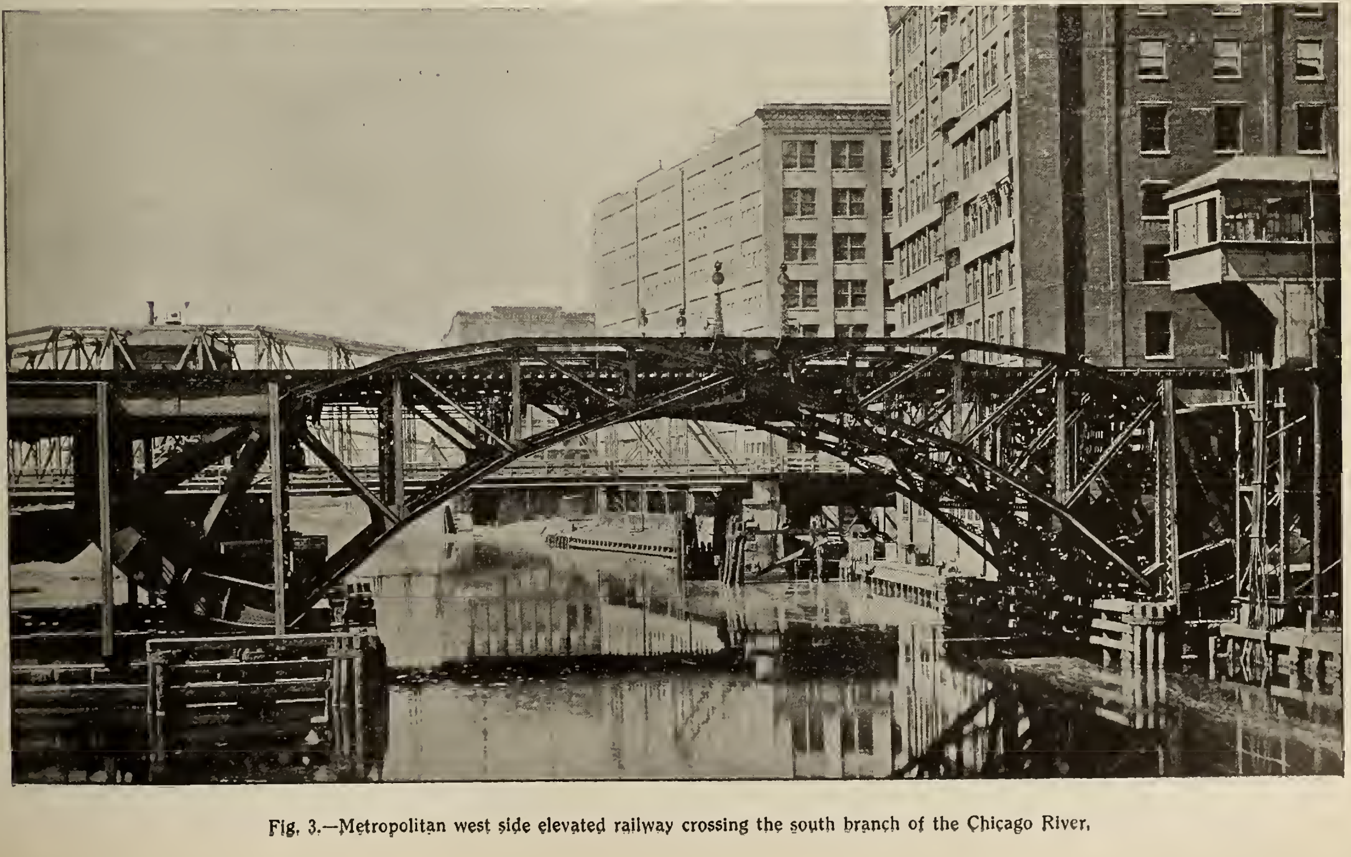


Fig. 3.—Metropolitan west side elevated railway crossing the south branch of the Chicago River.

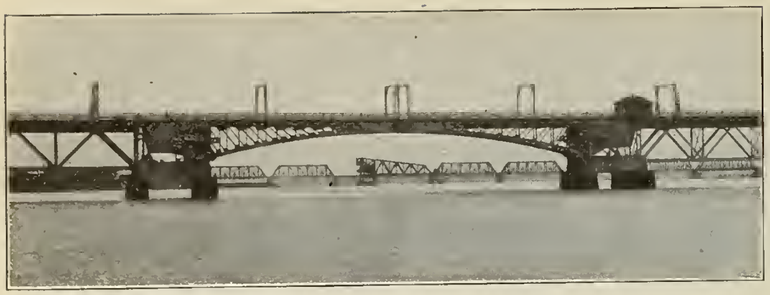


Fig. 4.—Rolling lift bridge over the Connecticut River at Saybrook, Conn.

bridge would be expensive to construct has led to the use of what have been termed transporters or transfer bridges. They are similar to ferries and usually consist of a car or platform either suspended from a high overhead track or supported on a track in the bed of the channel. This platform travels back and forth across the channel as is required to accommodate the traffic, and offers no serious obstruction to navigation at any time. While this type of bridge cannot be said to be in common use, a number of them are in service at the present time.

It is interesting to note in connection with a study of the various types of movable bridges in use that, with the possible exception of very special types which have proven unsatisfactory in service, all the various types of bridges which have been designed are represented by bridges in use to-day. This indicates that the development of movable bridges has not been so much an improvement on the old types as it has been a development of new types to meet new conditions. In localities where early conditions exist to-day old types of bridges are still being built.

Most of the early bridges were operated by hand. For the most part they were comparatively small, labor was cheap, and the modern efficient methods of developing mechanical power unknown. Even the large double leaf swing bridge over Penfeld River at Brest, which provided a clear channel of 350 ft., for half a century the widest clear channel provided by any movable bridge in the world, was originally designed to be operated by hand. Later hydraulic power came into quite general use in Europe and steam power in America. It is only within the last few years that electrical power has been used. At the present time electrical power is used almost exclusively for the operation of movable bridges. The ease with which it can be transmitted to any desired point and its property of being instantly available with no consumption of energy when no work is being done, makes it superior to other kinds of power for locations near a source of continuous supply. Most modern bridges are provided with an auxiliary driving mechanism which is usually operated either by hand or by oil engines.

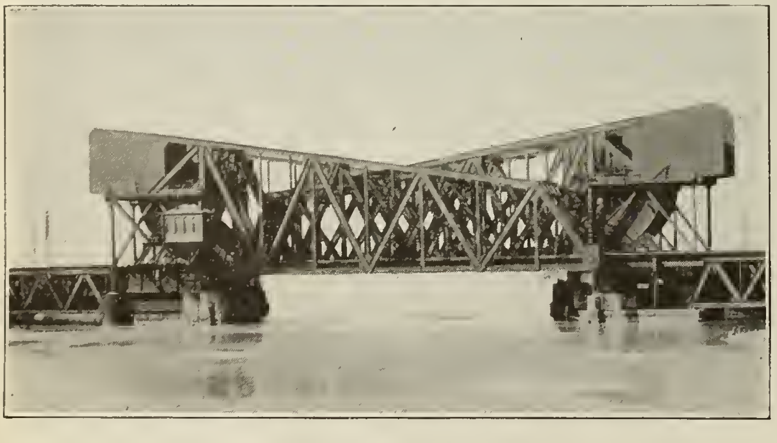


Fig. 4a.—Eight-track bridge, Chicago.

As stated above, many of the early moveable bridges were supported on pontoons and were opened by floating the draw span to one side. One of the more important bridges of this type still in use is the one which for a number of years has carried the C. M. & St. P. Railway over the Mississippi River, between Prairie du Chien, Wisconsin, and North McGregor, Iowa. The river at this point is about 7,000 ft. wide, including an island which divides the stream into two channels each of which is navigable, and the bridge, except for the draw spans, was originally a pile trestle. Each of these draw spans was carried on a single float, 41 ft. wide, 6 ft. deep, and 408 ft. long. The level of the track was adjusted to the varying stages of the river by blocking confined by a frame and adjusted by means of hydraulic jacks. The range of variation between high and low water was 22 ft. The elevations of the deck of the bridge was adjusted by the bridge tenders at times when they were not occupied in operating the bridge. Girders projected beyond the ends of the draw span and when the bridge was closed, rested on seats on piles provided to receive them. These girders prevented any live load coming on the floats near the ends and eliminated any harmful effects that might result from a slight difference in level between the fixed and floating decks. The bridge was operated by a 20 h.p. steam engine and could be opened or closed in about three minutes. The bridge was designed by John Lawler and was built in 1874. It was rebuilt in 1882; the Wisconsin end was again rebuilt in 1898 and the Iowa end in 1900. It still carries the traffic of the C. M. & St. P. Railway over the Mississippi River at this point.

A similar bridge was built over the outlet of Lake Champlain at Rouse Point in 1851. This bridge was 30 ft. wide and 303 ft. long, and was designed by Henry R. Campbell.

Swing bridges, which are the most familiar of all the various types of movable bridges, consist essentially of a truss or girder span which is balanced over a turntable on which it rotates about a vertical axis. The turntable consists of a pivot at the center of a circular track. The pivot serves to center the bridge and in some cases carries part of the load of the superstructure. Rollers on the circular track carry the remaining portion of the load. The bridge is balanced wherever possible by placing the turntable at the center of the span, in which case two channels are provided for navigation, one on each side of the pivot pier. In cases where it is undesirable to locate the pivot pier in the center of the channel, one nd of the bridge is made longer than the other and the short end is counterweighted so as to bring the centre of gravity of the while moving structure at or near the centre of support. Where such a bridge is used only one channel is provided. The pivot pier is set on one bank and the long arm of the bridge spans the channel leaving the full width open to navigation. Where two such bridges are used together, one on each side, a very wide channel can be obtained. Where this arrangement is used, the shore ends of the spans must be anchored, when closed, to prevent the moving leaf from tip-

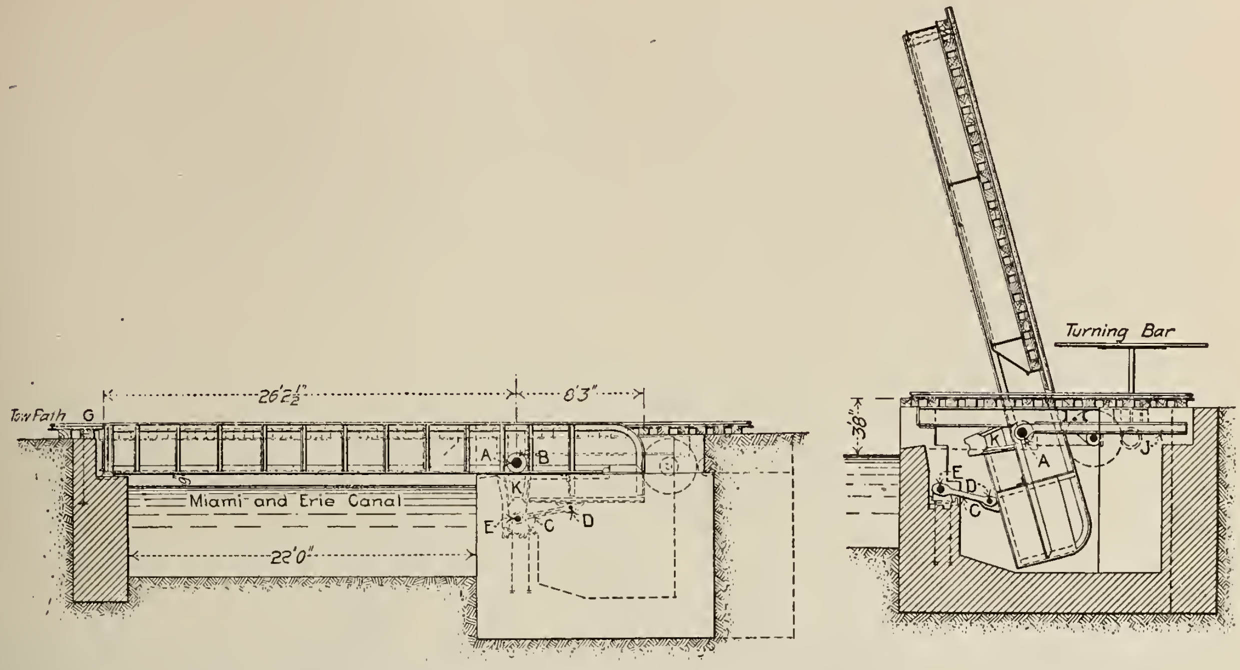


Fig. 5.—Single-span bascule bridge at Delphos, Ohio.

ping under the action of live load on the channel end.

The trusses acting as cantilevers will deflect under the action of the dead load while swinging so as to hit the end supports when the bridge is swung shut, unless some provision is made to lift the end of the bridge above its normal position when it is opened. This is done in a number of different ways. Besides with a centre circular track are lifted bodily by hydraulic pressure, or the ends are lifted by shortening an adjustable section of the top chord at the centre or by means of a toggle mechanism at the ends.

When the adjustment of the end supports is such as to cause them to take only a portion of the dead load, leaving the balance to be carried by the trusses acting as cantilevers, the trusses are in reality continuous over the centre support. Such a design is economical but a slight variation in the adjustment of the supports from what has been assumed causes such a variation in the resulting stresses that the scheme is not entirely satisfactory. For this reason engineers are inclined to sacrifice whatever gain may result from the continuous girder effect by providing an adjustable panel in the top chord at the centre by which it may be relieved of all stress when the bridge is closed, thus causing the two ends of the bridge to act as separate single spans. The uncertainty of the continuous girder effect has also been eliminated by adjusting the end supports so that the ends of the trusses will just touch, but transfer no dead load to them when the bridge is closed. This causes the trusses to carry the dead load as cantilevers and the live load as continuous trusses.

The double leaf swing bridge at Tarante, Italy, has pivot piers clear of the channel. The shore or short arms of the trusses are counterweighted so as to balance the long arms when the bridge is swinging, and are anchored to the masonry when the bridge is closed so as to prevent the bridge from tipping under the action of the live load on the channel arm. The curved bottom chord gives an arch effect which is very pleasing in appearance.

A similar bridge over Penfeld River at Brest, built in 1861, provides a clear channel of 350 feet, which was the record width for a clear channel provided by a

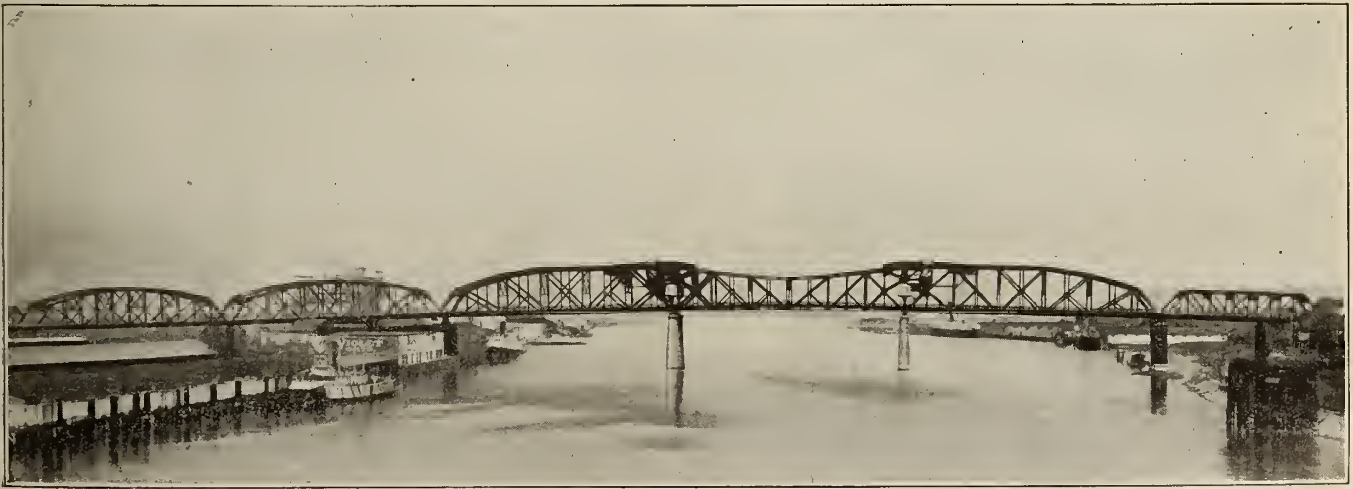


Fig. 5a.—Broadway bridge, Portland, Ore.

movable bridge until the new vertical lift span over the Missouri River at Kansas City was completed in 1912. A swing bridge at Havre has two leaves with unequal arms. When closed the short end is anchored to the masonry, after which the centre support is lower so as to transfer the load to the masonry at the front edge of the abutment where proper support is provided. This method of supporting the bridge when closed reduces the length of the cantilever subjected to live load, throws the point of support a considerable distance in front of the centre of gravity of the superstructure thereby reducing the live load moment to be balanced by the anchor, and increases the effective lever arm of the anchor so as to greatly reduce the stress to which it is subjected.

Figure 1 shows two swing bridges over the Missouri River at Omaha, which carry the double track of the Omaha Bridge and Terminal Railway Company Each swing span is 520 feet long, longer than any other movable bridge in the world. The bridge was completed in 1903. Waddell & Harrington were the consulting engineers. Most American swing bridges with centre pires are of this general type.

The Joliette Bridge in the port of Marseilles has a moving leaf which turns about a pivot supported on a hydraulic ram. The shore end of the truss, which is shorter than the channel end, carries wheels which run on a track on the shore. The bridge is very close to the water and most of the traffic on the canal consists of low barges. To permit of the passage of these barges without swinging the bridge, the hydraulic ram which carries the pivot is raised, thereby raising the front or channel end. This gives ample head room for the passage of the barges. The bridge was built in 1878.

The main road from Chester to Manchester crosses the River Weaver at a point where the surface of the ground is gradually subsiding due to the mining of salt in the district. For many years a plate girder swing bridge was in operation, but its gradual subsidence, averaging 4½ inches per year for 16 years, had reduced the clear head room until it became necessary to replace the old bridge with a new one, giving greater head room. One of the main points which had to be considered in designing the new bridge was the impossibility of preventing a concentrated load from settling under the action of its own weight.

In order to prevent settling, the bridge was supported on a floating pontoon whose buoyancy, which could be varied at will, was somewhat less than the weight of the superstructure. This pontoon had an air-tight deck 1 ft. below normal water so that neither its buoyancy nor elevation was affected by the level of the water. The pontoon, which turned with the bridge to which it was rigidly attached, floated in a chamber provided for the purpose and was surrounded by cast-iron piles which carried a gridiron girder. This gridiron girder supported a track and the portion of the weight of the superstructure not carried by the pontoons was carried on a series of rollers running on this track. The track served the further purpose of keeping the bridge properly centered. By keeping the buoyancy properly adjusted the portion of the stream bed under the point of support of the bridge was subjected to but little greater load than at other points. The load on the rollers was also comparatively light and the friction to be overcome in operating the bridge correspondingly small.

In 1893, in anticipation of the building of this bridge, the engineer in charge, Mr. John Arthur Saner, converted a cattle bridge in the same neighborhood into the type just described, and upon its proving satisfactory the larger bridge was built and put in operation in 1899.

Conditions similar to those governing the design of the bridge over the River Weaver near Manchester were found at the crossing over the Hoogly, that connects Calcutta with Howrah. The present pontoon bridge, which was built in 1874, is to be replaced by a modern bridge. The river bed is soft mud and the swift current scours so badly that it is practically impossible to put a pier in the channel. The old pontoon bridge has been satisfactory, but there are drawbacks to this type of bridge for so important a point which make it undesirable to repeat the design. A substitute has been proposed in the form of a double leaf swinging bridge on floating piers. Two such designs have been submitted. For one design, the shore ends of the two approach spans rest on fixed abutments and the stream ends of the approach spans and the swinging spans rest on a floating pontoon which rises or falls as the water level in the river changes. For the other design, the bridge is supported in a similar manner

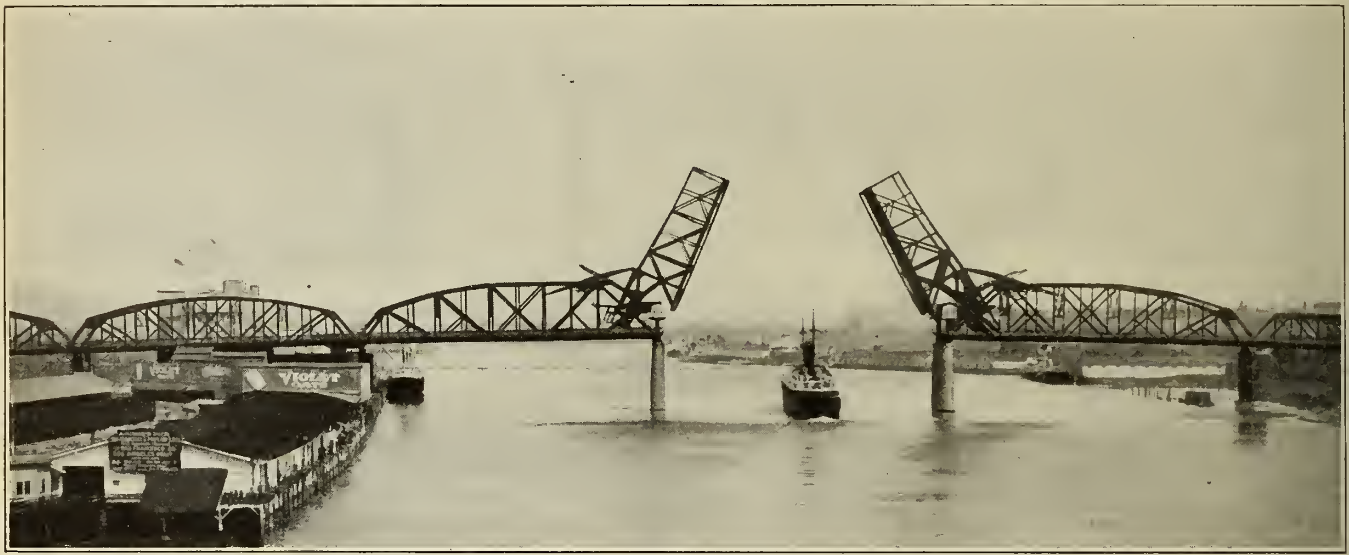


Fig. 5b.—Broadway bridge, Portland, Ore.

except that the pontoons which have a buoyancy greater than the maximum dead load plus live load are anchored into the river bed so as to be slightly submerged when the water is at low level. These anchors prevent the pontoons from rising and falling with the water level in the river and the bridge is at a fixed level at all times. This system is the invention of Mr. F. Forssell and the patent rights are held by Head, Wrightson & Company, Limited.

In addition to what are usually known as swing bridges, there have been a number of other types of movable bridges built which open by rotating about a vertical axis.

One of these is known as a bobtail swing bridge. The pivot is at the extreme end and the weight of the moving leaf is balanced by an overhead counterweight atttached to the rear end. A bridge of this type carries the C. M. & St. P. Railway over Ogden Canal just off the North Branch of the Chicago River at Cherry St. It was built in 1902. This road has other bridges of the same type.

A type of temporary wooden bridge which has been used by the New York, New Haven & Hartford Railroad consists of four wooden deck trusses, each of which is pivoted to a swing in a horizontal plane. These trusses are all pivoted to a swing beam near their front end. Rods fastened to this swing beam pass up to the top of a tower and support the outer ends of the trusses as the bridge is moved. When the bridge opens, the trusses swing together and in the open position are just far enough apart to clear. The tower is prevented from tipping forward when the bridge is in the nearly closed position, by tension rods which run from the top of the tower to the top of a group of piles. It is prevented from tipping sideways when the bridge is open, by a stiff-leg frame on the compression side and a tension rod on the tension side. Provision is made for lifting the front end of the trusses a few inches before opening the bridge so as to clear the support. The bridge is operated by hand. When it is closed the front end rests upon pile bents and the live load is carried the same as for a simple span.

The Miami and Erie Canal Transportation Company, of Cincinnati, Ohio, has a charter for operating the canal by electric towage, using trolley locomotives on a track along the towing path. At several points the track crosses the canal, and in order to make the curves as easy as possible the crossing is made on a skew bridge, of a type designed by Mr. Ward Baldwin. It was desired to build these bridges as cheaply as possible. The bridge consists of two parallel plate girders pivoted at one end and supported on vertical posts at the other. The heels of the girders are connected by a semi-circular drum which rests on rollers. Two I-beams framed between the two girders carry the centre bearing. The posts under the outer end of the girders are carried on rollers which run on a circular steel track supported on piles at the bottom of the channel. The operating pinion is carried on the lower end of the post and meshes with a rack concentric with and just outside of the steel track. A recess is cut in the side of the canal to allow the end post to swing back and leave the channel clear when the brige is open. The bridge can be operated by electric motors or by hand.

A temporary bridge which was built over the Chicago River to accommodate pedestrians while the new permanent bridge at State Street was being erected, swings about a pivot supported on timber piles at one end and is carried on a pontoon at the other. This design was submitted by Roemheld & Gallery.

A horizontal automatic swing bridge, which is used on a canal near Bordentown, N.J., consists of a single leaf horizontal swing bridge with a counterbalanced short arm. The track is slightly inclined toward the canal, and the centre of gravity of the moving parts is between the centre of rotation and the channel so that when the bridge is opened the centre of gravity is raised. The weight of the bridge makes it swing shut. There is no one to tend the bridge, it being opened by the canal boat pushing against it, and is closed by its own weight. A number of similar bridges are in use on the Ohio State canals.

What is known as the Victoria Bridge is one of the largest horizontal rolling bridges which have been built. The moving leaf is carried by lattice girders which are supported by the approach span. The chan-

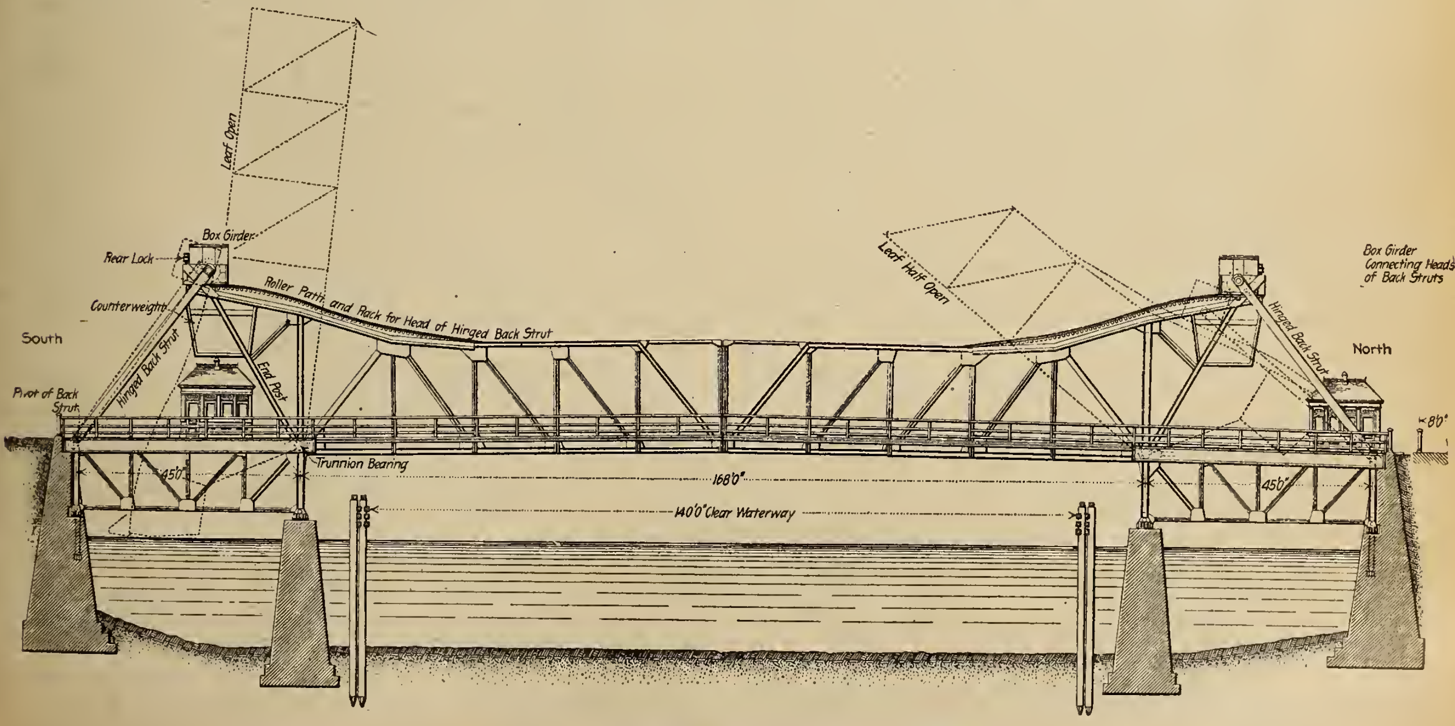


Fig. 6.—Bascule bridge at Ashland avenue, Chicago.

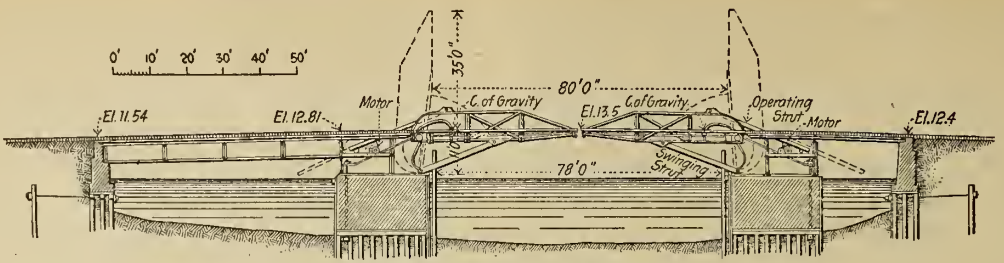


Fig. 7.—Huron street bridge, Milwaukee, Wis.

nel ends of the girders are balanced by counterweights on the shore end. To close the bridge the moving leaf telescopes so as to allow it to pass beneath the floor of the approach span. It is then rolled back on wheels which run on a track supported by the approach girders. The design was made by Mr. T. W. Barber and was selected from among eighteen designs submitted. The bridge was formally opened to traffic by Mr. Gladstone, June 2, 1897.

A wooden horizontal draw bridge designed by Mr. C. E. Burroughs, of Norfolk, Va., is applicable to short spans. It consists of a stringer span mounted on a carriage which travels on an inclined steel track. The carriage is inclined so that the floor of the moving leaf is always horizontal. When the bridge is closed the front end of the moving leaf rests on a pile bent and the live load is carried the same as on a simple span. When the bridge is to be opened, the hinged door in the floor is lifted and fastened to a hook provided for the purpose and the carriage is drawn back on the inclined track. The combination of the inclined track and hinged door in the floor allows the moving leaf to clear the approach span as the bridge is opened. The front end of the bridge is supported in the open position by means of tie rods passing over a gallows frame. The moving leaf is counterbalanced by a second carriage loaded with ballast and running over a track inclined in the opposite direction from the one which carries the moving leaf. These two carriages are connected by a steel cable. The bridge is operated by hand.

A horizontal rolling bridge has just been constructed over the Milwaukee River at Oneida street, Milwaukee, to take care of the foot traffic at this crossing while the new permanent bascule bridge is being erected. It consists of two through trusses carried on a counterweight carriage which runs on a track supported on piles. The bridge is opened and closed by running this carriage back and forth on the track. In the closed position the front end of the bridge rests on the dock and the live load is carried the same as in the case of a simple span. The approach span on the same side of the channel as the track is a platform parallel to the track. The pedestrians go from the platform to the deck of the bridge by passing through the next to the end panel of the truss, from which the diagonal bracing has been omitted. The shear on this panel has been taken care of by a plate-girder in the top chord. The passage to the dock at the opposite end of the bridge is the same as for an ordinary span. This bridge was designed and constructed under the supervision of Mr. L. J. King, as superintendent of bridges and public buildings.

In cases where the street traffic is light and the water traffic is heavy so that the latter should be given more consideration than the former, use is made of what has been called transporter bridges. One of the more important examples of this type of bridge is the one over the Ship Canal at Duluth, Minn. This bridge consists of two structural steel towers about 400 feet apart between which is a track carried by steel trusses. This track supports carriages which run back and forth across the channel. Platforms with decks level with the roadway on either side of the channel are suspended from these carriages by means of a steel frame. When pedestrians or teams wish to cross the channel, they walk onto this platform and the platform is carried across the channel by the carriage to which it is attached. The clear headroom over the water is 135 ft. The bridge was built in 1904 and 1905. Other bridges of the same type have been in successful operation at other points.

Another type of transporter bridge crosses a narrow arm of the sea between St. Malo and St. Servan, on the north coast of France. At low tide the bed of the sea is bare. A track was laid on the bed from dock to dock and a carriage conveying a platform on the top of a steel tower, travelled back and forth across the channel. The bridge was operated during high tide and in currents due to a tide of 5 or 6 nautical knots. This bridge was devised and built by Mr. Leroyer, a local architect, about 1871, and was successfully operated for a number of years.

As has been previously stated, bascule bridges were used in the early days as a means of defence. They have been used to a limited extent to provide crossings over navigable streams since early in the 19th century, but their use was not common until the adoption of the bascule type for the new London Bridge. The general scheme of this bridge is shown in Fig. 2. The draw span is a double leaf bascule bridge supported on fixed trunnions and counterbalanced by counterweights attached to the shore end at such a point as to make the centre of gravity of the whole moving structure fall at the centre of the trunnions. Each leaf is supported on four lattice girders. Instead of each girder being supported on a separate shaft the four girders of each leaf are supported on a single shaft 21 in. in diameter and 48 ft. long. This shaft is supported on eight journal boxes with steel roller bearings. These journal boxes are carried on curved girders, one on each side of the bascule girders, which rest upon the front and rear walls of the trunnion piers. By curving these girders up at the shore end the counterweight falls below the bascule girders and does not interfere with them when the bridge is opened. When the bridge is closed, a resting block in front of the trunnion comes in contact with a live load support and the tail end is anchored to the masonry so that the moving leaf acts as a cantilever. The effect of the front support is to relieve the trunnion of the live load and to reduce the stress on the anchors. The bridge is operated by a pair of pinions which mesh with a rack quadrant fastened to the tail end of the girders. The clear channel is 200 ft. and the distance centre to centre of trunnions is 226 ft. 6 in. The counterweight is composed of lead and cast iron.

Mr. William Scherzer invented a rolling lift or bascule bridge but died before any of his bridges were constructed. After his death the design was taken up and a large number of his bridges, usually known as the Scherzer Rolling Lift Bridge, have been constructed and are now in use. The first one of these bridges was built in 1895. It is shown in Fig. 3. The bridge consists of two leaves, each of which is supported on two trusses. The tail ends of these trusses are in the form of a circular arc and rest on tracks carried by the foundation, counterweighted so as to bring the centre of gravity of the moving leaf at the centre of the circular arc. The bridge is opened by rolling the circular arc on the track on which it rests. Since the centre of gravity is at the centre of the arc it is not raised or lowered as the bridge is moved, and all the work which has to be done is that required to overcome the wind, friction, and the inertia of the moving part. Since the moving leaf rolls back as it is opened, the front end does not overhang the channel, and the angle of opening and the length of span can be reduced to a minimum. When the bridge is closed the tail end is anchored to the foundation and the live load on the front end is carried by the bascule trusses acting as cantilevers. Where there is sufficient headroom over the channel to permit of the use of a deck bridge quite pleasing effects may be obtained with this type. Fig. 4 shows the 212 ft. double leaf highway and electric railway bridge over the Connecticut River at Saybrook, Conn. The outline of this bridge gives an arch effect but the load is carried as a cantilever.

A Scherzer bridge carries the double track of the Tehauntepec National Railways of Mexico across the harbor at Salina Cruz, Mexico. When the bridge is closed a pin at the end of the top chord of one leaf engages a pin bearing at the end of the top chord of the other leaf. Pin bearings are also provided where the moving leaves rest upon their supports when in the closed position so that the bridge is supported at the three points and the two leaves act together as a three-hinged arch to carry the live load. A number of double leaf bascule bridges not only of the Scherzer but of other types, act as a three-hinged arch to carry the live load.

There are a number of Scherzer Rolling Lift Bridges worthy of note. The double track, double leaf railroad bridge over the Chicago River at Taylor Street, Chicago, built in 1901, is the longest double leaf cantilever bascule railroad bridge ever built. It has been subject to very heavy railroad traffic and to frequent operations for a period of thirteen years and is still in use. A similar bridge which has just been completed forms the only connection between the Island of Ceylon and the mainland of India.

Another Scherzer Rolling Lift Bridge, notable because of the number of bridges together, is the one known as the eight track bridge over the Drainage Canal near 31st street, Chicago. The eight tracks of the Pennsylvania Railroad, the Baltimore & Ohio Railroad, and the Chicago Junction Railway are carried on four independent bridges placed side by side. By having adjoining bridges pointing in opposite directions, the tail of one on the same side of the channel as the front end of the other, the tracks are spaced a minimum distance apart.

There are three multiple bridge Scherzer Rolling Lift Bridges on the main line of the N. Y., N. H. & H. Railroad between New York and Boston. Each crossing is composed of three double track bridges placed side by side.

Figure 5 shows the bridge which carries the Pittsburg, Fort Wayne & Chicago Railway over the Miami and Erie Canal at Delphos, Ohio. This bridge, which is of the single leaf bascule type, is counterweighted so that the centre of gravity of the moving leaf is at A, the centre of the shaft about which the leaf rotates. A strut C is pivoted to the lower side of the girder at D and to the masonry at E. The shaft A carries the wheels B, for which a track is provided on the top of the masonry. When the bridge is closed the pedestal K rests on the pin E and lifts the wheels B off the track. To open the bridge the shaft A is pulled back

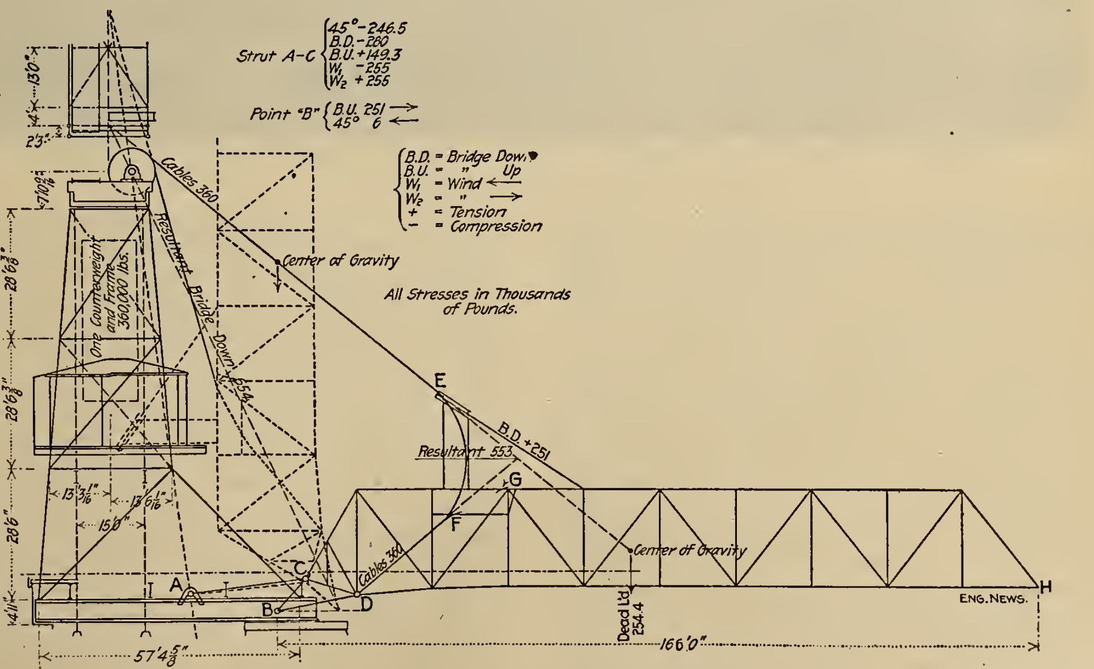


Fig. 8.—Bascule bridge at Ohio street, Buffalo, N. Y.

horizontally by the operating strut J. The moving leaf revolves about E until the wheels B come in contact with the track, after which the shaft A moves horizontally and the leaf moves about A. This horizontal motion has the effect of pulling the upper part of the moving leaf back away from over the channel, thus reducing the length of span required for a given channel and also keeping the counterweight away from the front wall of the counterweight pit. This bridge, which is the first one of its type, was designed and erected by the Strobel Steel Construction Company of Chicago in 1901. It was invented by Theodor Rall. Through bridges of this type have also been built.

The largest bridge of this type is the one known as the Broadway Bridge, Portland, Oregon. It is 70 feet wide and 278 feet long centre to centre of rollers. At the time it was built it was the largest bascule bridge in the world. Another Rall Bridge crosses the Neva.

Figure 6 shows what is known as the Page Bascule Bridge invented by John W. Page, of Chicago. The bridge shown, the first one built of this design, is over the Chicago River at Ashland Ave., Chicago. It consists of two pairs of through cantilever bascule trusses and two pairs of deck approach trusses. The bascule trusses are pivoted on the trunnions supported on the end posts of the approach spans. The shore ends of the bascule trusses extend back of the trunnions and are connected to the approach trusses by means of hinged anchor struts. These struts are hinged to the approach girders at the lower end, and the near and far struts are connected at the upper end by means of a heavy box girder to which they are pivoted. This box girder is supported on a pair of rollers at each end which run on the curved top chord of the bascule trusses. This box girder carries the operating machinery which transmits the power to operating pinions, one for each truss of each leaf. These pinions mesh with the racks which are fastened to the top chord of the trusses. The counterweights which balance the bridge are of two parts,—one part is rigidly attached to the tail end of the bascule truss, and the other is carried on the box girder. The first part has a fixed position and the second has a changing position relative to the trunnion and the centre of gravity of the moving leaf. By properly proportioning the different dimensions and properly shaping the curved track on the top chord of the bascule truss the bridge can be balanced in all positions.

A late adaptation of the Page patent is low and has semi-through trusses which greatly reduce the objectionable appearance of the Ashland Avenue bridge. The moving leaf is balanced by the approach span which is pivoted at the shore end and is carried by a segmental rocker at the trunnion end. This rocker rolls on a curved surface on the heel of the bascule trusses of such shape as to cause the bridge to be balanced in all positions.

A bridge built at Huron street, Milwaukee, Wisconsin, is shown in Fig. 7. It is a double leaf bascule bridge but the motion of the moving leaf instead of being a motion of rotation about a fixed axis is a combined motion of rotation and translation produced by a pivoted link and a curved guide. A large triangular supporting girder is rigidly anchored to the masonry. A strut or link is pivoted to this supporting girder at its lower left hand corner. At the upper left hand corner is a pair of rollers mounted on pins. The upper end of the strut is pivoted to the lower side of the main bascule girder. The tail end of the bascule girder shaped to a smooth curved surface is rigidly supported by web plates and rests upon the rollers carried by the supporting girder. The moving leaf is counterweighted so as to bring the centre of gravity between the supporting rollers and the strut pivot in the bottom of the bascule girder. This causes the curved surface to be pressed firmly down on the rollers. As the bridge opens the centre of the upper strut pin, a point in the bascule girder moves in a circle about the lower strut pin

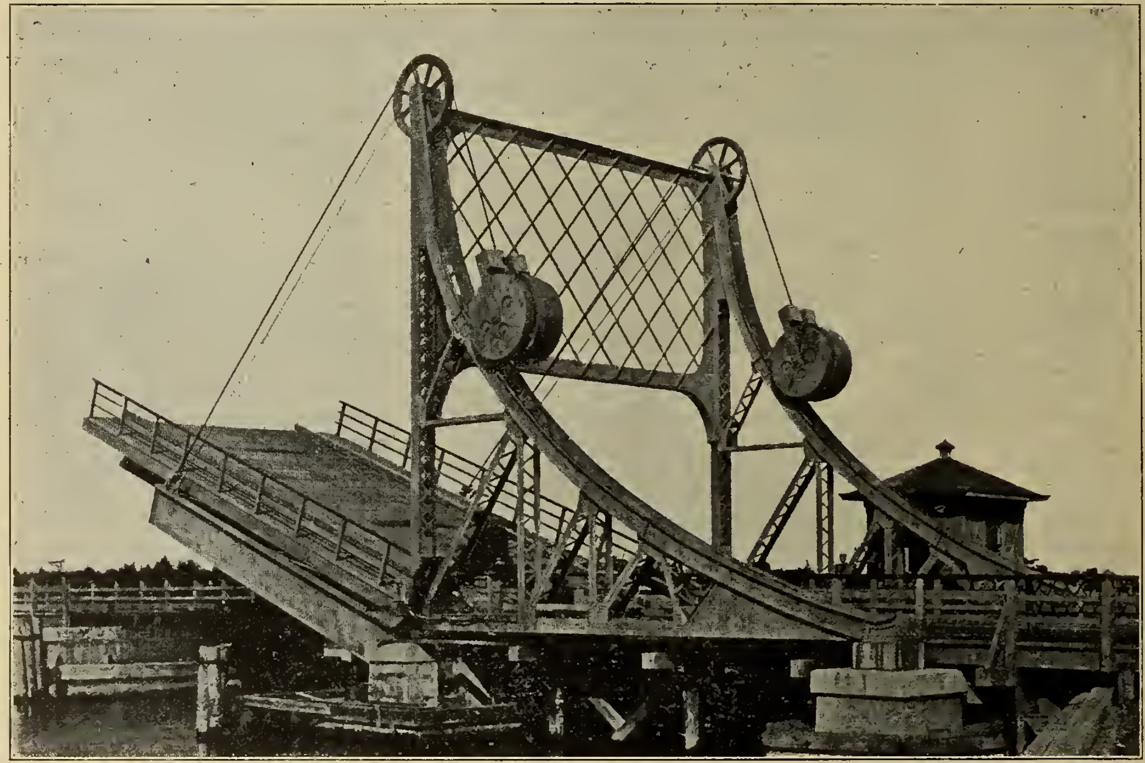


Fig. 9.—Harway avenue bridge, Brooklyn, N. Y.

as a centre. The curved surface moves along over the top of the supporting rollers. The motion of the centre of gravity of the moving leaf is a combination of the two motions just described and by properly laying out the curved surface it can be made to move in a straight horizontal line. With such a motion the bridge is balanced in all positions. The moving leaf is acted upon by three forces, axial compression in the strut, normal pressure of the roller against the curved surface, and the weight of the moving leaf acting vertically through its centre of gravity. For the bridge to be balanced these three forces must intersect at a common point. As the bridge was built, the tail end of the bascule girder was allowed to strike against a support when in the nearly open position and relieve the pressure on the roller. When the bridge is closed the moving leaf acts as a cantilever and the strut and roller hold the bridge in position against the action of the live load. This design was made under the supervision of Mr. Geo. H. Benzenberg, then City Engineer for the city of Milwaukee. The bridge was opened for traffic January 1, 1897.

The various bascule bridges described support the channel end of the moving leaf on the bascule trusses acting as cantilevers. This produces large dead load stresses in the bascule trusses, necessitates the use of comparatively short counterweight arms, and makes it necessary to carry the weight of the counterweight as well as the weight of the moving leaf upon the trunnions. By supporting the channel end of the moving leaf on a cable passing over a pulley at the top of a tower and fastened to a counterweight the counterweight arm is increased, the weight of the counterweight and part of the weight of the moving leaf is removed from the trunnion and the dead load, and in some cases the live load is carried on the bascule girders acting as simple beams. There is the disadvantage, however, that this type of bridge requires the use of a tower which is expensive and usually unsightly.

One bridge of this style built over the Buffalo River at Ohio street, Buffalo, New York, in 1907, was designed by Mr. Brown. A diagrammatic sketch is shown in Fig. 8. The bridge is a single leaf bascule hinged at the point C and balanced by means of a counter-weight supported on a cable attached to the moving leaf and passing over a large pulley at the top of a tower. The cable is attached to the moving leaf at the point D and passes over the curved guide F E. The pivot C instead of being fixed is connected by hinged struts to the fixed point A and the point B which is free to move between horizontal girders. A hydraulic piston moves the point B horizontally. This raises the point C and causes the moving leaf to revolve about C. As the leaf is raised the moment of its weight decreases. The curve of the guide E F is laid out so that the counterweight acting through the cables produces a moment which varies as the moment of the moving leaf so that the bridge remains balanced in all positions. When the bridge is fully open, forked guides at G straddle the cable and prevent the leaf from falling onto the tower. When the bridge is closed it carries the live load as a simple span.

The bridge at Harway Ave., Brooklyn, N.Y., is shown in Fig. 9. It is a single leaf bascule bridge with fixed trunnions. To balance the bridge a steel cable attached to the bascule girder passes over a large pulley at the top of a tower and is attached to a counterweight which rolls on a curved girder. This girder is so formed as to cause the counterweight to balance the moving leaf in all positions. When the bridge is closed it carries the live load as a simple span. The bridge was designed by Mr. Joseph Mayer; Mr. E. S. White was the engineer in charge, and Mr. J. S. Langthorn was Resident Engineer of Construction. It was completed in 1898. A bridge of this type was built at Michigan Ave., Buffalo, N.Y., in 1897 and is still in use. A number of other bridges of the same type have since been built.

(The concluding portion of this article—Part II—will be published in our next issue.)

Ultimate Strength of Carbon-Steel Models of Quebec Bridge Members

Diagrams of Destructive Tests; Anchor Arm Lower Chord Models Buckled Under Unit Load of 50,886 Pounds

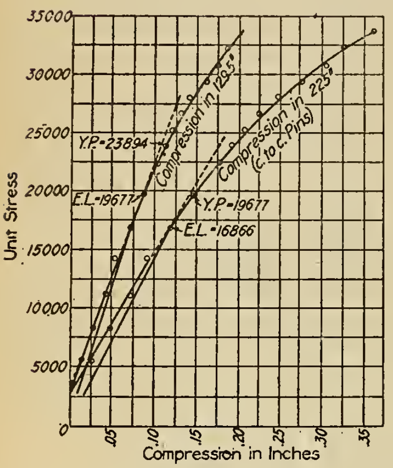
AMONG the eighteen tension and compression tests of models to a scale about one-quarter the natural size of the members of the trusses in the 1800-ft. span of the new Quebec Bridge which have recently been made there are four sets on carbon-steel sections of the compression lower chords L10-12 in the anchor arm. These members have the same position in the truss as those which failed in the Quebec Bridge collapse several years ago. In the new bridge structure they are proportioned for heavier total loads and for smaller unit stresses, and their design differs materially from that of the corresponding members in the former structure, which had four deep vertical webs connected only by end diaphragms and by top and bottom chord latticing.

The models of the new bridge members have been made and tested in the interest of the accepted design, which has been prepared after investigation of similar members in the other largest recent spans and may be considered as the latest development in compression members to resist excessively heavy stresses in long-span trusses.

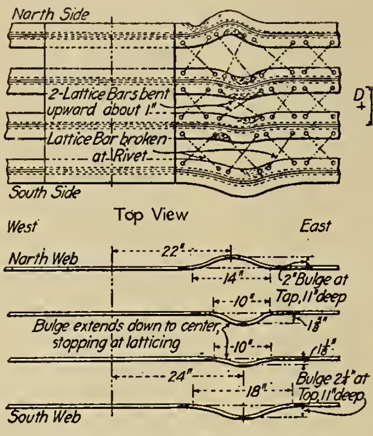
Models

The models, about 30 in. wide, 18¾ in. deep and 18 ft. 9 in. long, weighed from 7610 to 1650 lb. each and were marked TX13-A, B, 1 and 2. They had four deep vertical webs connected by full-length horizontal longitudinal latticing and tie plates on the centre line and on the top and bottom flanges. They had a ratio L/R — 38 and a nominal cross-sectional area of 70.65 sq. in., which, however, owing to the inaccuracy of rolling the plates and angles, was reduced to an actual area of about 69 sq. in., making the sections a little more than 2 per cent. light. Specimen tests made from the plates and angles showed an elastic limit varying from 39,780 to 42,700 lb. They had half-hole bearings in both ends of the webs, which

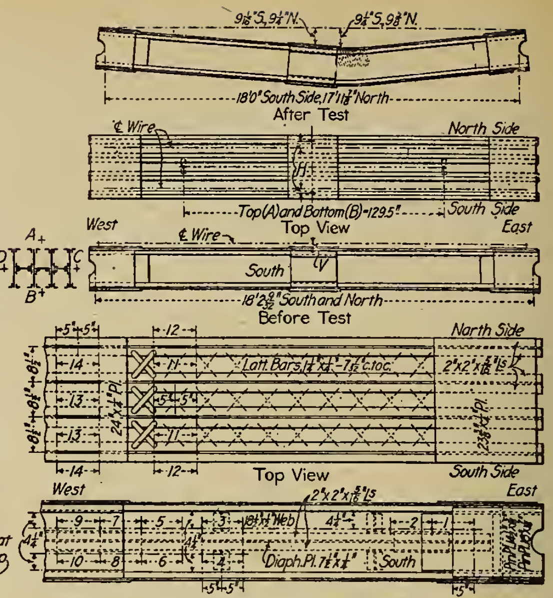
Compression diagram and manner of failure of model TX13A-1 and location of compressometers.



Compression in Inches


North Side
2-Lattice Bars bent upward about 1"
Lattice Bar broken at Rivet
South Side
Top View
West
East
North Web
22"
14"
10"
2" Bulge at Top, 11" deep
Bulge extends down to center, stopping at latticing
10"
24"
18"
Bulge 2¼" at Top, 11" deep
South Web

Top View showing Distortion of Webs



Locotion of Howord Compressometers

were reinforced to give 52 sq. in. of bearing for the 6½-in. pins.

The accompanying illustrations are of special interest in that they include the first published details of the bottom chords of this great span. All of the models were symmetrical about their centre transverse axes and those marked A were made with both ends exactly like the left-hand end of the illustration, with the flanges of the centre webs connected by lattice bars. The models marked B were exact duplicates, except that they were made with both ends like the right-hand end of the illustration, with the flanges of the middle webs connected by tie plates. The models were supported by end pine alone, without intermediate counterweights to carry part of the weight.

General Results

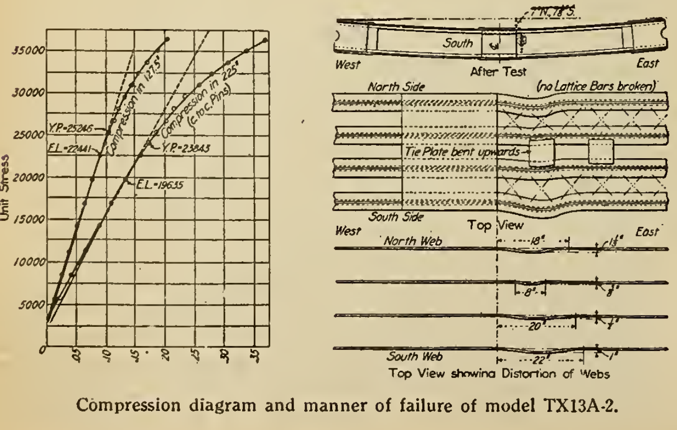
The elastic limit of the models, taken as a whole, varied from 16,866 lb. to 22,441 lb., and in all except the last case was much lower than the elastic limit determined on a long length measured in the centre of the member. One model failed with a maximum unit load of 39.359 lb. The other three models endured without failure several repetitions of the maximum load of the 2,800,000-lb. capacity machine. Afterwards they were weakened by holes drilled through the webs near the centre of the piece, and failed under loads of from 43,060 lb. to 50,886 lb. per square inch computed on the reduced sections.

Model TX13A-1 failed by lateral deflection in the planes of the webs and by buckling of the webs near the centre of the piece.

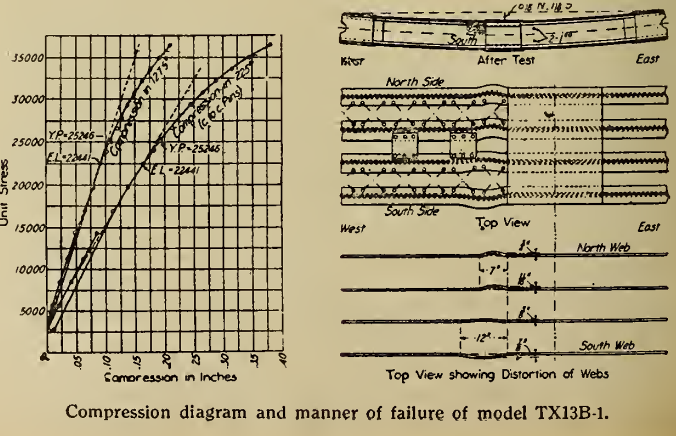
Model TX13A-2 was compressed to the full capacity of the machine, which produced a stress of 40,657 lb. without failure. Afterward two 1-in. holes were bored through each of the four webs near the centre of the piece, reducing the section from 68.87 to 64.87 sq. in., and the same maximum total load was applied three times at high speed, producing a unit stress of 43,164 lb. per sq. in., and on the third application caused the failure of the model by a downward deflection and the buckling of the webs near the centre. The strain gage locations were all made on one latticed face of the model, none of them being made on the webs.

Model TX13B-1 endured without failure the full load of the machine, producing a compression of 40,565 lb., after which two 1-in. holes were bored through all four of the webs near the centre of the model, reducing the sectional area from 69.026 to 65.026 sq. in., and the same maximum load was applied again seven times at high speed, producing a stress of 43,060 lb. and finally causing the failure of the piece by bending at the centre in the plane of the webs and by the buckling of the webs near the centre. The strain gauges were applied at ten points on the webs on both sides of the model and at eight points at the upper latticed face.

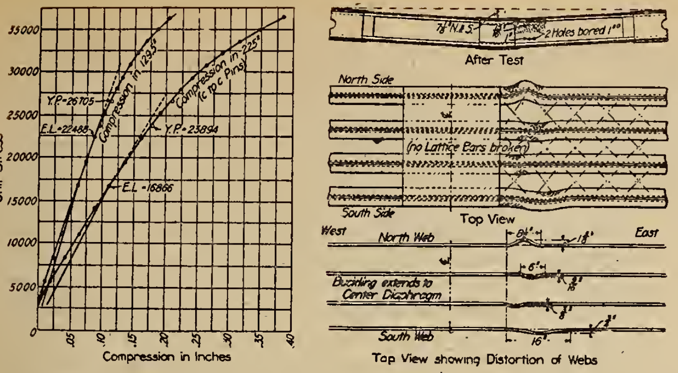
Model TX13B-2 was loaded to the full capacity of the machine, gauge 867.7, producing an ultimate compression of 40,565 lb. on the full section of the piece, which it endured without failure. The pressure was released and two 1-in. holes were bored through all



Compression diagram and manner of failure of model TX13A-2.



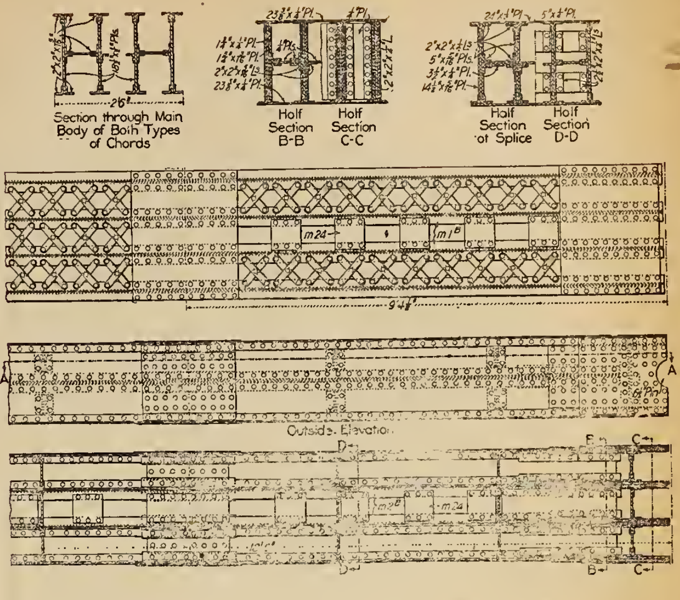
Compression diagram and manner of failure of model TX13B-1.



Compression diagram and manner of failure of model TX13B-2.

Mark	ELASTIC LIMIT In portion of member at center	In full length	Ultimate strength	Percentage model is light of nominal weight	MAX. VERT. DEFLECTION AT CENTER, INCHES Before test	After test	Date of test, 1913	TIME OF TEST READINGS First	Last
	Pounds per square inch								
TX13A1.......	19,677	16,866	39,359	2 51	3/64	7 4/32	February 28	1.55 P.M.	5.26 P.M.
TX13A2.......	22,488	16,866	43,164	2.51	1/32	7 1/8	March 4	9.27 A.M.	1.14 P.M.
TX13B1.......	22,441	22,441	43,060	2.29	21/64	......	March 3	9.05 A.M.	1.05 P.M.
TX13B2.......	22,441	19,635	50,886	2.3	1/32	7 1/8	March 5	1.10 P.M.	4.45 P.M.

Compression tests of carbon-steel, lower-chord models.



Detail of carbon-steel model of anchor arm, lower-chord section.

four webs, reducing the sectional area 4 in., and the same loading was repeated ten times. As this did not produce failure, two more holes were bored and the same loading repeated several times. Finally the section was reduced 14 in. by boring six holes through the two south webs and eight holes through the two north webs and the same load again slowly applied and maintained for 10 minutes, producing a compression of 50,886 lb. per sq. in. on its reduced cross section of 55,026 sq. in. After 10 min. application this load caused the failure of the model by bending transversely at the centre in the plane of the webs, which were buckled somewhat at the location of the holes.

Mr. C. N. Monsarrat is chairman and chief engineer and Messrs. Ralph Modjeski and C. C. Schneider are the members of the board of engineers of the Quebec Bridge. The tests were made for the St. Lawrence Bridge Company of Montreal, contractors for the superstructure of the new Quebec Bridge, by the Phoenix Bridge Company, of which Mr. John Sterling Deans is chief engineer, Mr. P. L. Szlapka, designing engineer, and Mr. Charles Scheidl, assistant engineer in charge. The tests were made under the direction and personal supervision of Mr. James Howard, engineer-physicist, Bureau of Standards, Washington, D.C.—Engineering Record.

Bacillus Coli in Water Supply—Its Significance and Importance

By Joseph Race, F.I.C.*

WHILE too much importance has been attached in the past to the presence of b. coli in water used for domestic supplies, it is regrettable that the pendulum is now showing a tendency to swing too far in the opposite direction. The paper of Geo. A. Johnson (Pro. Amer. Waterworks Assoc. 1913), of Johnson & Fuller, New York, is an illustration of this movement. The all too common practice of using arbitrary and empirical methods in the bacteriological examination of water is partially responsible for the present status res, and in this regard bacteriologists have only themselves to blame. As will be shown later, the mere presence or absence of b. coli in an arbitrarily fixed amount of water may have no significance when considered without regard to other circumstances; and in attempting this we are merely opening the way for criticism. The Committee on Standards of the American Public Health Association (1912) evidently recognized the futility of such procedure when they recommended that quantitative estimations should be made of b. coli. They add: "Qualitative results, when viewed superficially, may seem easier to obtain than, and quite as conclusive as, quantitative results; but detailed evidence shows that in general the quantitative tests are by far the most fruitful source of information." It would appear that the committee might have gone further and deprecated the use of qualitative tests except under extraordinary circumstances. This procedure has also had a deleterious effect on those connected with sanitary work, and who, by reason of their lack of familiarity with the technique employed have accepted this sophism. The author believes that, even with all the assistance that quantitative methods of examination afford, it is often difficult to give a sound opinion on the hygienic quality of a water supply, and that it would be folly to revert to the older methods.

There are many points of difficulty surrounding the significance of b. coli, and on several of these the present knowledge is very meagre. Almost everyone is aware that b. coli is common to the excreta of nearly all the higher and lower animals. In cold-blooded animals the occurrence is less constant, and more or less discordant results have been obtained. Dr. Amyot (Trans. Am. Pub. Health Assoc., 1901) concluded that b. coli is not normal in the intestines of fish, and that when present is due to the polluted environment. The tendency among animals generally

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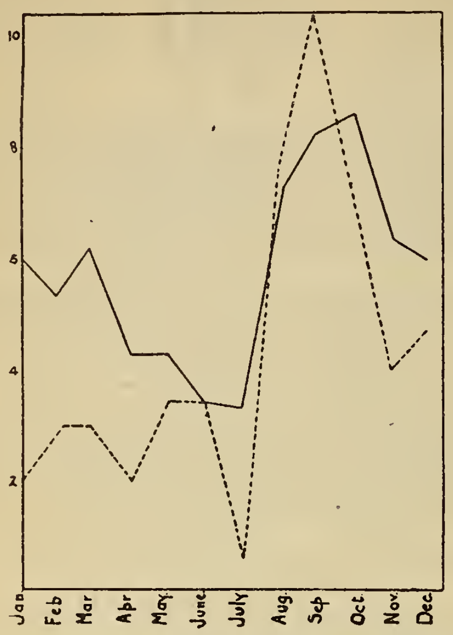
*City Bacteriologist, Ottawa, Ont.

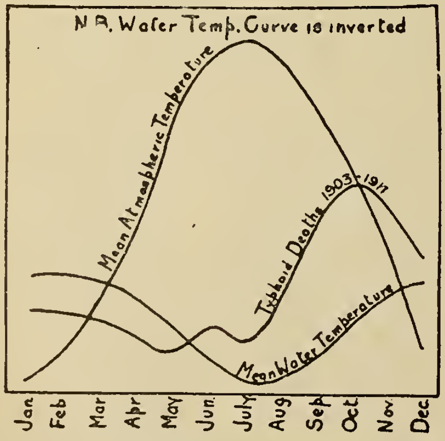


The full line shows average number of typhoid deaths in Toronto each month, 1903 to 1911, before filtration was begun. The dotted line shows the average in 1912-13, after filtration.

is for b. coli to become rarer as the zoological type becomes lower. None of the lower types, however, are susceptible to typhoid fever, man being alone in this respect, so that there is a possibility of having b. coli unaccompanied by b. typhosus. This b. coli has, therefore, no significance.

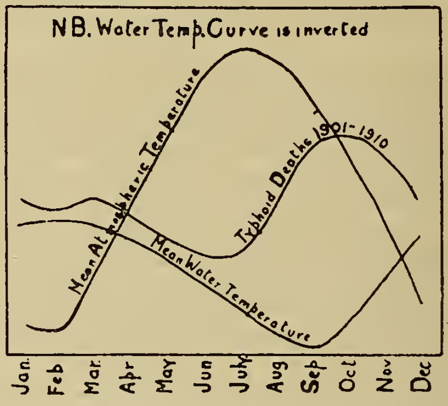
In reference to the b. coli present in a water supply and due to human sources, it is important that information should be obtained regarding the total population on the watershed, the prevalence of typhoid and the probable period elapsing before the diluted sewage reaches the water services of the town under consideration.

The population is comparatively easy to obtain, and the typhoid death rate can, in most cases, be calculated from past records. In addition to the mortality, however, the case incidence should also be considered, as this has an important bearing on the probable ratio of b. coli to b. typhosus by its influence on the number of carriers. In Great Britain and certain portions of Europe the incidence is much lower and the case mortality higher than on this continent, so that the ratio of b. coli to b. typhosus is entirely different. It is possible that this ratio is ten times greater in North America than in Europe, and much greater significance ought, therefore, to be attached to b. coli here.



These curves illustrate the average number of deaths from typhoid in Ottawa each month, 1903 to 1911, compared with the mean atmospheric and water temperatures.

The period elapsing between the discharge of the sewage and the withdrawal of the water is the most important factor, and in this connection the temperature of the water must be considered. Typhoid bacilli, in the absence of suitable food material, find an unsuitable environment in water and, the cell energy being entirely of a katabolic nature, they die rapidly. It is obvious that this increase with the period of storage, and a consideration of the mechanism of the process also leads to the conclusion that the katabolic wasting increases with rise in temperature and vice-versa. Dr. Houston and others have supported this hypothesis, by numerous and conclusive experiments. It is important, therefore, that the bacterial contamination should be considered in its relation to the water temperature, and this leads to the conclusion that b. coli should be regarded as having greater significance in winter than in summer. In the diagram illustrating this point the temperature curve has been inverted so as to conform with the viability of typhoid in water. In both the Ottawa and Toronto diagrams the typhoid death curve and the inverted water curve show a noticeable parallelism in the winter months, and as it is during these months that outside cases are at a minimum, the typhoid incidence is probably water-borne. The plotted figures for Toronto before and after the operation of the filtration plant show that it is this winter rate that has been reduced, whilst the summer prevalence, mostly due to imported cases, has remained unaffected. In Ottawa, with efficient sterilization with hypochlorite, only one case of typhoid has been reported for the first four months of the present year. These results show what can be accomplished by water purification, and also that the significance of b. coli must not be considered in an arbitrary manner.



The average death rate from typhoid in Toronto each month for the years 1901 to 1910 compared with mean atmospheric and water temperatures.

Attempts have been made to belittle the value of the b. coli test because the b. coli content of the water supplies of certain cities did not bear a constant relation to the typhoid death rate. In such statements the sources of the typhoid incidence are not stated, and this, in many cases, may lead to erroneous conclusions.

Advantages of Method in Construction Work

By James L. Stuart, Contracting Engineer, Pittsburgh

PERHAPS there is no business which responds more quickly to what is termed "business methods" than does the average piece of construction work. Certainly there is no business with more diversified interests and trades connected with it than the modern structure, be it railroad terminal, factory, office building, hospital, or hotel.

It has not been more than 20 years, at most, since the construction of buildings was left entirely to practical men, who had themselves worked up from positions as artisans or laborers to positions of leadership in constructional lines. Some of these leaders in the past were most talented and even brilliant, but they did not bring with them into the business, except in rare instances, the methods of the trained engineer or the progressive business man, their principal assets being nervous force, executive ability and practical knowledge of the building trades. However, as building construction became more complex and of greater magnitude, the necessity of trained men who understood the engineering problems and who appreciated the application of business methods necessary to bring "order out of chaos" became more apparent, and now both engineering knowledge and modern business methods are most necessary to get proper results as to economy and quality in all of the larger undertakings.

Methods and Organization

In order to successfully construct a building, it is necessary that one should anticipate each step in the progress of its developments and outline a complete system for its erection, including the various steps from the time the drawings are received from the engineer or architect until the building is turned over completed to its owner. The first step in such a process is to make a complete estimate of the cost of the structure from the drawings and specifications, including every item mentioned in the specifications or shown on the drawings. In addition to this there are other small items which are not mentioned in the specifications, but which are necessarily a part of the cost of the building and should be included as such. Under the latter are such items as the cost of administration, liability insurance, temporary buildings, expediting, tools and machinery, and numerous smaller items. These estimates of cost were originally made up by the contractors themselves and were but approximations as compared with the present method of compiling them. In the latter method every advantage is taken of the prevailing market prices when the estimate is made, of the conditions of the labor market, the physical condition under which the work is to be done, and the season of the year. In a properly prepared estimate the unit prices should vary on each individual piece of work, whether figured at the same time or not.

After the estimate has been made of the total cost of the building—and I think an estimate should be made of every building whether the work is to be let on a lump sum contract, cost plus a fixed sum, or on a time and material basis—the next step is to make up a time schedule allowing fixed periods of time for the completion of each part of the building. This must be done most carefully, as on this schedule is based the dates of completion of the different contracts for material and the contracts with sub-contractors for furnishing such portions of the work as are not to be executed by the general contractor's force in the field. This time schedule is made after a thorough study of the drawings, the site of the new project, and a familiarity with the estimate which, as I have said before, gives the quantities of the different kinds of material and assists in estimating the length of time required to complete the various stages of the work.

After the estimate and the time schedule are completed and the contracts for material and labor have been entered into, the real work begins.

A dozen or more sets of drawings are procured from the architect or engineer, a copy of same placed on file in the main office of the builder, one copy sent to the job office and the others distributed among various sub-contractors who have to make up their shop drawings and prepare certain materials to be later installed in the building. A careful record must be kept of these drawings and to whom they are addressed and the date on which they are sent. While the various departments of the main office keep thoroughly in touch with the work in the field, and the material in preparation, at this point, if the work is of sufficient magnitude, it is turned over to one particular member of the contractor's force, preferably a trained engineer, whose duty it is to keep in thorough and constant touch with all the drawings and all of the correspondence. He also has access to the files of the sub-contractors, contracts, contracts for materials, the original estimate and all other information pertaining to that particular piece of work. It is then his duty to follow up their shop drawings, the submitting of the same to the architect for approval, the ordering of materials by the sub-contractors, and the progress being made through the fabricating shops and mills. This following-up process is part of his daily routine and from time to time reports are made to the superintendent in charge of the actual field work to enable him to know when the material is to be received, when the sub-contractors will have their men and material on the job, all of which enables him to shape up the field work so that certain portions of the building will be ready for certain sub-contractors at a fixed time. It is also his duty to keep track of the change orders and the changes made in the construction of the building, whether it be an addition or a subtraction. You can readily understand how necessary it is that all sub-contractors should be advised of changes, for often when they are conceived in the mind of the owner, their interference will be more far-reaching than he or anyone else anticipated.

A proper executive organization to do the field work is most important. It is far better to have too much assistance in the field than too little. First, there must be a superintendent who possesses rare abilities as an executive, who understands drawings and specifications thoroughly, who has had wide experience in building work and who has a knowledge of the different trades so as to be able to anticipate far in advance of his requirements. Above all, he should be able to create in those working under him, including the workmen employed by his department, and foremen and workmen of the different sub-contractors, an enthusiasm in their work, a desire to see it grow steadily, and to do it in the most substantial manner possible. If the work is of sufficient magnitude he should have an assistant superintendent, or possibly two or three of them, a large enough clerical force to do the timekeeping, and to keep an accurate cost record, and he should segregate the cost of the additional work which was not originally provided for. All of this work, if permitted to lag for even a day, becomes most complicated, and if not accurate, its value is entirely destroyed. In addition to this it is the duty of one of the clerks to send to the main office each day an accurate and concise report on what has been done during the day, the state of the weather, temperature, etc. As the building nears completion, work in the main office lessens, and it is usually an excellent idea to have the man in charge of the particular job in the main office to get in actual touch with the building and to assist the superintendent in picking up the loose ends and in getting each trade completed as rapidly as the progress of the building will permit. The man from the main office is thoroughly familiar with each trade, knows just what changes have been made in the work, has a splendid knowledge as to how long it will take each trade to complete its work, knows the difficulties under which each has been laboring and can finish his "following-up process" from the field more intelligently than if he were to remain at the chief office.

The Cost of Work

The cost of a piece of work is always of interest. The estimating department has access to the daily and weekly cost reports which are compiled in the accounting department, and from these they can compare and report to the proper person whether or not the work is being done each day or each week within the amount allowed for the same in the original estimate. If the work is not being done within this cost, and if the unit prices vary considerably from day to day, an investigation is at once made at the building to ascertain the reason for such fluctuations, to advise the superintendent of the discrepancy, and to see if ways and means cannot be found to bring the cost within its proper allowance—the estimate having been based on the cost of similar work under the same conditions, the proper average should not vary greatly from the amount allowed in the estimate.

The two following examples serves to illustrate the methods which were used in connection with the erection of a large manufacturing plant and a modern hotel building:

During the latter part of May, 1910, a manufacturing plant near Pittsburg covering 15 acres, was almost totally destroyed by fire. All of the buildings were brick, some with wooden trusses and slate roofs, but the greater number were constructed with steel frames and cement tile roofs. The fire in and around these steel structures was so intense, however, that most of them collapsed of their own weight, and were only a mass of twisted steel, broken cement tile, brick and mortar, all of which it became necessary to remove in order to reconstruct the plant. We first received orders to clear the site, and subsequently were instructed to proceed with the reconstruction of the buildings. Fortunately, the power plant had not been greatly damaged, and, as a large portion of the plant had to be electrically driven, we were able to get sufficient current of high voltage to use in cutting up, or, I should say, burning apart the collapsed steel frame, all of which was so badly damaged that it was loaded on cars and sold as junk.

After the site was cleared we began excavating for the new foundations, starting on the buildings which would be required first and those in which the greatest amount of machinery was to be installed. This scheme was followed so as to enable the entire plant to be completed at about the same time. It was the desire of the manufacturing company to commence manufacturing about the first of October, or earlier if possible. The key to this particular situation was to get the steel, of which there was about 4,800 tons. After consultation with the operating and executive departments of the manufacturing company, the order in which the different buildings were to be completed was decided on and the dates were fixed for the delivery of the steel for each building and were included in the schedule for the completed buildings. The structures were quite simple, similar to most of the modern factory buildings, but in order to live up to our schedule we knew we must keep continually in touch with the bridge company and see that nothing was permitted to lag or be left undone in order to make the deliveries as they promised. Our "expediter" was put in charge of the job at once and during the first month spent most of his time between the order department of the bridge company and the steel mills where the plain material was being rolled. After the last of the orders for the plain material had been sent to the rolling mills he devoted his time more particularly to the drawing room of the bridge company and reported daily just what progress was being made in designing, detailing and checking, the number of draftsmen employed, and the progress made on each building. At times it was found that the checking department was overbalanced by the detailing department and that the designing department was not turning out sufficient work to keep the detailers and the checkers busy. This was adjusted by numerous meetings between the bridge company, the executive department, the manufacturing company, and ourselves. I might say, at this point, that the principal requisites of an expediter are, a thorough knowledge of the work to be performed, a pleasant personality, and the ability to interest the people who are actually doing the work —in this case the men who made out the mill orders, the draftsmen, the different foremen in charge of the rolling mill, and the foremen in the fabricating shop. All should be made to feel that their interests are parellel and that what is good for one is good for all. As soon as the drawings for one of the buildings were completed, we saw that this work was put in the shop at once, where someone had already attended to the delivery of the plain material, and that no time was lost in fabricating and shipping the same.

At times during the preparation of the drawings it was found necessary to urge the bridge company to employ additional men in all departments. This required considerable tact and force as, naturally, the heads of the different departments, do not care to have their routine changed, or, as they express it, "meddled with." This phase of the difficulty can be overcome only when it is possible to arouse sufficient interest in that particular piece of work. When the work was started our expediter received from the rolling mills, from which he knew the steel was to be furnished, a list of their daily rollings, and we saw to it that certain materials were gotten in on dates at which the first rolling of that particular material was made. This saved considerable time, and we were able to get all of the plain material delivered before the shop drawings were entirely completed on the first building. The meetings between the heads of our department and the heads of the bridge company were most useful. Our expediter was usually on hand, and we were able to discuss the progress made since the last meeting, the condition of the work in the drafting room and in the shop, and to devise ways and means for overcoming any obstacles which had arisen, due either to lack of men or to want of materials.

The steel was erected as fast as the work was got out of the mill, fabricated, and delivered. We insisted on its being fabricated in sequence so that any materials delivered at the building could be immediately put in place. It had been previously decided at which end of the building the work would commence, and our superintendent in the field was advised of this fact and was also kept in thorough touch with the progress of the different stages of the steel. As the cars of steel were loaded and shipped out they were put in the hands of the tracing department of the manufacturing company, and our tracing department as well, and shipments were followed up until they were finally landed at the site. Our tracing department had, prior to this time, made the acquaintance of the different employees of the railroad through whom the records of the movement of the cars were to pass, as well as those who had direct charge at the transfer points. After the steel had been delivered the rest of the work was a mere question of brick, mortar, sand, gravel, cement, window frames, sash, roofing material, and sufficient workmen. Of course, there were large quantities of all these materials required and in order not to delay the work it was imperative that certain amounts of the same be delivered and put in place prior to the delivery of the steel.

The same general method was applied to the construction of the Statler Hotel, except that the work was much more complicated and required many more details. There were approximately 90 sub-contractors and material men in and around the building from almost the day it was started until its completion, and it required a great deal of patience, perseverance and hard work to get the different trades to dovetail into each other throughout, so that those who did the preparatory work would finish and leave in time to permit the finished material to be erected in a proper and substantial manner. On the Statler Hotel we found it necessary from about the first of June until a few days before the building was turned over to Mr. Statler, to insist on daily meetings of all of the sub-contractors on the work, together with the architect's representative and others interested in the building. At these daily meeting each trade was taken up separately with the principal representatives of all the other trades present. He was questioned regarding the progress of his work and was told to state whether or not he was being retarded by any of the other trades. If it was found that his work was being hampered he was made to state explicitly and in detail to what extent and how.

The advantage of having all of the sub-contractors together at one time can readily be seen, as it eliminated innumerable quarrels between the foremen of the different trades and many misunderstandings which invariably arise due to the fact that the workmen and foremen are not always capable of expressing their troubles in an intelligent manner and, when they are busy, many times do not take the trouble to express themselves at all. It was rather hard to get them to continually attend these daily meetings, as they were held in the evening after they were supposed to be through with their work. We always tried to make the meetings as pleasant and as short as possible and never permitted ill-feeling to exist between the several trades arising from the discussions at the meetings. A typewritten report of each meeting was posted on the general bulletin board so that each of the sub-contractors would have access to the same during the following day.

The following points were brought out by Mr. Stuart in the discussion of the original paper:

If we can get contracts under reasonable competition, we much prefer to do work on the lump sum basis, as the work is then entirely in our hands and whatever we can save by any unusual attention or ingenuity is ours. However, if there is a chance that the competition will not be fair, and we are after the job pretty hard, we are glad to take it on a commission basis. A great deal depends on conditions. If the contractor is thoroughly honest, and when I say "thoroughly honest" I mean if he has real conscience, then it seems to me that a commission basis is the best on which to operate from the standpoint of the owner, because he gets exactly that for which he pays.

When we take work on a commission basis, and we do a great deal of that work in Pittsburg, we make up an estimate of the actual cost of the work and tell the owner how much he is likely to expend. We do this for two reasons: One is that we do not want our organization to get into the habit of making any difference whether it is on a commission or a lump-sum basis. If you give the owner an estimate of his building, then it is everybody's purpose to keep within the estimate. The other reason is that we think it is only fair that the owner should know what the building is to cost, and we sometimes guarantee that work will not exceed a certain maximum sum.

The owners should be satisfied even though it may be a little more expensive to have the work done on a commission basis, as it saves them in other ways. For example, it gives the owner a chance to make changes and to have the work done in just the way he wishes, so as not to interfere with his business. Personally, I do not think it costs any more to do the work on a commission basis, especially if the contract covers several buildings or a long period of time. We now have three contracts on a commission basis which are yearly contracts, that is, unless they are cancelled before the close of the year they carry over to the next year.

I think the principal objection to percentage work is that the owners do not sufficiently trust the contractors. I know many honest contractors, but just as in other business there are same who are not honest.

We sometimes let some of the work to sub-contractors on a commission basis, but never when the work is of such character that it must be prepared away from the building, such as mill work, steel work, ornamental iron, etc. We have done our own plastering work, but we do not find it very advantageous, because most sub-contractors look after the work themselves as foremen. Fireproofing, painting and other trades are usually sub-let. Most people agree that to get some one who knows how to do it is worth the profit they pay to the contractor.—Engineering Contractor.

About 65 per cent of the Federal railways of Switzerland rest on steel ties and 35 per cent on wooden ties according to a recent consular report. The steel ties are in the form of inverted troughs with the ends bent down to close the troughs. The tie complete weighs about 160 lbs.

Tokio's municipal waterworks, which are reported to bring in an annual net profit of nearly $500,000, have lately received government sanction for new work, to cost $10,360,000, which will provide a system capable of supplying a population of 3,000,000.

Harbor Development Work at Vancouver, B. C.

The above illustration relates to the new causeway and sea-wall at Coal-Harbor, B. C., for the construction of which the City Council of Vancouver invited competitive plans last spring. Twenty-three designers competed but it is now learned that the plans of the City Engineer have been approved by the City Council.

Method of Finishing Concrete Alley Pavements

By John N. Edy, Asst. City Engineer, Billings, Mont.

IN 1911 and 1912 the city of Billings, Montana, improved certain alleys in the business district. Brick and wood block, at a probable cost of $3.55 and $3.35 per square yard, respectively, were considered too expensive; and it was finally decided to construct a 7½-inch concrete pavement on a 6-inch gravel base. The contract here described provided for the paving of approximately 900 linear feet of 20-foot alley, or a total of 2,000 square yards; 1,650 square yards was constructed in the fall of 1911, the remainder being placed in September, 1912. The contract price was $2.25 per square yard, which included grading but did not include the construction of inlets and catch basins.

The drainage problem was perhaps unusually complex. The alleys were 3-way or "T" alleys. At each of the three street ends permanent concrete sidewalks and alley-crossings had previously been constructed, the grades of which had been established without regard to the probability of paving the alley. A small strip of brick paving in one of the alleys, numerous area-ways and variable floor elevations, all added to the difficulty of making this adjustment. A minimum longitudinal grade of 0.3 per cent was adopted, and after careful consideration it was decided to drain all three sections of the alley to the centre of the block. At this point were placed three inlets leading into a catch basin, which, in turn, emptied into a Y-branch of the main sewer in the long alley.

The catch-basin was built of concrete, with 6-inch walls, 3 by 4 feet inside bottom dimensions, vertical walls 3 feet high. The basin is 6 feet deep and was covered with a 22 by 22 inch open c.i. grate.

A transverse slope of 0.4 feet in 10 feet was deemed ample, and it has so proved. (As will be noted in a succeeding paragraph, it was not always possible to secure just this section, on account of existing alley-crossings, the necessity of observing floor grades, etc.) The contract called for the construction of a two-course pavement; 6 inches of 1:6 gravel-concrete base, and a 1½-inch topping or wearing coat of 1:2 mortar. It is likely that this plan would have been followed throughout, had it not happened that near the completion of the first alley the contractor was unable to obtain sands. He was then permitted to finish the day's work with one course, or 7½ inches, of 1:4 concrete. This one-course pavement proved so easy to lay, and appeared to be so satisfactory, that supplementary plans were drawn providing for such construction on the remainder of the contract.

The sub-grade was shaped to conform to the cross-profile of the concrete and a sub-base of 6 inches of gravel or cinders was placed throughout.

The pavement was divided into square sections by placing a ½-inch transverse expansion joint every 20 feet. These joints were usually made by removing the wooden expansion strips and filling the opening with a tar filler. On the 1912 work, however, the expansion strips of soft wood were not removed, but were trimmed off to the surface of the pavement and left in place.

No provision was made for a longitudinal joint in the centre, nor at the sides of the alley. Where no building interfered the inside of forms was set to exact line and left in place. In case the adjoining building was on line, thin strips were set for the sole purpose of guiding the templet used.

The pavement herein described has been referred to as of reinforced concrete, when in fact the reinforcement was used only over sewer trenches. For this purpose ½-inch round steel rods were used, spaced 12 inches on centres. The length of the rods was not less than 4 feet greater than the width of the trench. In case of two parallel sewers 5 feet apart, the rods were sufficiently long to span both trenches.

After preliminary grading had been completed, finish grade for the sides was marked on buildings or on stakes. The idea was to have these side forms accurately set, enabling the transverse slope and centre grade to be secured by means of a properly shaped templet. The sub-grade and sub-base were also checked by measuring down, from the bottom of the templet, 13½ and 17½ inches, respectively.

It will readily be seen that the cross-slope of existing alley crossings might not conform to that of the pavement. In fact, not one of the six crossings in place did so conform. In some instances it was necessary to reconstruct portions of the crossing, when it was possible to make the sides and centre of the pavement parallel. In one case it was not possible to use the templet at all, a row of finish-grade stakes being set down the centre of the alley. These stakes were set uniformly 4 inches low, and upon them were placed 2 by 4's set on edge. The concrete was then rodded off on both sides of the centre and finished, after which the 2 by 4's were removed and the space filled with mortar.

Usually, the centre grade was made straight between the lowest point at inside of alley crossing and the cover of catch basin. The sides of the pavement were then run out approximately level with the sides of the crossing until the proper section was obtained, when the templet was put in use.

In order to mark permanently the side elevations along brick buildings, wire nails were driven into the mortar joints. In all cases straight grades were "shot in" by setting up at one controlling point and tilting the telescope of the level to the proper H. I. above the other.

After the sub-grade had been prepared and thoroughly rolled, the gravel or cinder base was placed, shaped, and compacted. This sub-base was sprinkled with water before the concrete was deposited. The machine-mixed (wet) concrete was conveyed to place in one-horse concrete carts. This method of handling the concrete was satisfactory, except to this extent: On account of the narrowness of the alley and the projection of area-ways and other obstructions, it was extremely difficult for the horses to turn and back into position without roughing up the gravel sub-base. In fact, where cinders were used, it was not at all unusual for the horses' hoofs to throw cinders onto the surface of the placed concrete, and for the cart wheels to completely ruin the finished grade of base. Under such circumstances it was necessary to provide an extra crew to reshape the cinder bed. However, this difficulty was not so apparent where gravel was used in the sub-base, in which case a slight sprinkling of sand kicked on the concrete caused no great damage.

The reinforcement was placed by an inspector, who also checked the grade of the pavement surface by means of the templet. The expansion strips were placed by the contractor, as located by the inspector.

While the two-course work was in progress, it was customary to place 20 lineal feet of 6-inch concrete base, which was shaped to a rough surface, and then immediately covered with the 1½-inch mortar coat. The surface was floated and brushed at the proper time. But in constructing the one-course pavement, the men spreading were forced to exercise more care, in order to work mortar to the surface and properly shape and smooth the concrete. With this type of pavement much of the success of the finisher depends upon the good work of the spreaders.

The "finish" referred to was obtained by thorough floating with a wood float and then brushing with a stiff broom.

As soon as the concrete was sufficiently hardened it was covered with a layer of earth or sand, and kept moist for a period of five days. In good weather the pavement was thrown open to the public after the expiration of five to seven days. Pit-run bank gravel was used throughout, no river gravel being permitted in the concrete.

The pavement described in this paper has been in use nearly three years; and while that is a very short time as compared with the probable useful life of the improvement, it is nevertheless possible to form certain conclusions as regards its apparent serviceability. In the first place, although the concrete has passed through extreme changes in temperature, no expansion or contraction cracks have developed, and although subjected to a very heavy traffic, there appears no appreciable evidence of wear. Within a month after some of this pavement was placed it was necessary to cut an opening to repair a leaky heating main. This opening was filled with gravel and permitted to remain until spring, when the concrete patch was laid. The new concrete has bonded perfectly to the old, it being difficult to detect the patch; there has been no ravelling whatever. During the past summer numerous openings were made to permit the laying of gas mains, and these patches are also hard to locate.

The concrete pavement is, of course, more noisy than the wood block, but not so noisy as the pitch-filled brick. The writer is advised by the street commissioner that the paved alleys are very easily cleaned.

The drainage system is giving good satisfaction, except that, in the writer's opinion, the minimum longitudinal grade had better be 0.5 instead of 0.3 per cent. The transverse slope might be reduced to 0.25 or 0.3 feet in 10, although there is no apparent reason for doing this. It would be possible, the writer believes, to reduce the thickness of sub-base to 4 inches, and of the concrete to 6½ or 7 inches, without affecting the usefulness of the pavement. The writer favors the one-course work, mixed wet in the proportion of 1:2:4, or 1:4 or 1:4½ (local) pit-run gravel. There appears to be no need for a longitudinal expansion joint.

The contractors' equipment consisted of one 14-foot mixer with steam power; two single-horse carts for conveying; wheelbarrows, etc.

The mixer was loaded from barrows, the distance from gravel pile to mixer being 40 to 50 feet. Cement was delivered to the mixer platform by team from the sheds.

Maximum haul for concrete was approximately 315 feet; minimum haul, 20 feet.

The earth sub-grade was rolled by a gasoline traction engine, which gave better service than a roller for the reason that areaways, manholes, poles, etc., rendered the use of the roller impracticable.

Construction Costs Less in Winter

INVESTIGATIONS by the Aberthaw Construction Company, Boston, in connection with the cost of component parts of the average reinforced concrete building, indicate that work in the winter season costs less than summer work. While it is not possible to put a definite figure upon the reduction in cost, yet some of the parts of the building lend themselves to this treatment and an estimate can be made for other items.

In addition to the direct saving in materials is the saving, which cannot be definitely fixed, due to the ease of securing materials promptly, thus avoiding delays and the incidental heavy overhead. Another factor arises from the ability of the contractor at the present time to put some of his picked men into the organization, thus getting better results than if he were pressed for men to finish work under way. In addition, the average contractor can give more direct personal attention in winter than at times when business is abundant. The three items just mentioned have been estimated at about three per cent. on the total cost of the building. If we add to this possibly 4½ per cent. or 5 per cent., represented by a reduction in the cost of materials, this makes a total saving of approximately 7½ per cent., as compared with last summer, and with conditions which may prevail again before many months are passed.

Costs and Other Features of Surfacing Track

IN doing any kind of track work with common laborers, the organization or distribution of the men is a matter requiring careful consideration and close attention, for it is the proper disposal of men which more than any other one thing effects the amount and quality of work done. It has been said with truth that a gang of poor workers well organized is a better gang and will accomplish more than will a gang of good workers poorly organized. Time and confusion are saved by assigning each man his task, and requiring him to remain as placed until otherwise ordered.

The value of organization is not fully appreciated by all track men, and is badly misunderstood as respects track work by those unfamiliar with the subject. The word not only designates placing men so that they will work harmoniously and advantageously, but it implies also that each man shall be placed at the work for which he is best fitted. One can readily see that this result cannot be immediately attained, but it is the idea aimed at; and not only must the physical makeup of the man be measured, but a man's disposition, age, willingness, natural skill, and familiarity with the work must also be considered. A man who shows a disposition to lag will many times hold his own against a more willing workman if the work is arranged on a competitive basis. For instance, if a laggard is placed where he must rehandle a certain amount of material which is being passed to him by another, he will, in many cases, do enough work to keep from being "snowed under."

The amount of work accomplished by the individual is very closely related to gang organization. The best men should be put in the lead, and wherever possible the work should be arranged so that each man will have to do an equal share with the head man, or else fall behind and be easily detected. It is characteristic of the laborer experienced in track work, that he is loth to admit the superiority of another man. When such a man is placed so that the amount of work he accomplishes is directly measured by the amount some other man does, he will generally do his share.

The greatest amount of work will be obtained from most gangs by treating them considerately, and this policy makes the work more pleasant for both laborer and foreman. "Driving" men is being done away with to a great extent, as it is becoming difficult to keep laborers when such a policy is pursued.

The idea that men should be treated considerately does not mean that discipline should be sacrificed. The foreman's discipline should be strictly maintained under all circumstances. He should personally see to it that each of his orders is obeyed. In case an assistant foreman is employed and the gang is not separated, all orders should in general be given through the assistant foreman. This will to a great extent prevent conflicting orders being given to one man. The assistant should be backed up by the foreman in all cases in order to maintain his authority.

In order to provide maximum and easy supervision, the men should be kept as close together as is possible, without interfering with each other. The scattered condition of a gang may be due to poor organization or to irregularities occurring in the work, and a foreman will show his ingenuity in arranging the work and the laborers so that the gang is kept compact.

The American Railway Engineering Association has specified that before ballasting a new track "all dirt above the bottom of the ties shall be removed." This is a very necessary procedure, for after the track has been ballasted, the part of the sub-grade directly under the track will be compressed and will settle, and this action will continue possibly for a number of months. So that even if the top of the grade is made level before initial ballasting, the top of the dirt sug-grade will gradually assume a longitudinal trough of ditch-like surface. The depth of this trough has actually been found to be from 8 to 10 ins. on a grade in Illinois, from which the ballast was removed.

Ballast of nearly every kind—gravel, cinders, crushed stone—is much more pervious to water than the dirt which is in the embankment. Rain water falling on these ballasts will soon penetrate to the dirt sub-grade. If there is a basin beneath the ballast, water will be retained on top of the sub-grade. If the original depressions made by the ties are left in the sub-grade, the greatest accumulation of water (which will cause softening of the track foundation) is immediately beneath the tie where the greatest pressure comes and where the greatest resistance should be. The softening of the grade will tend to allow the ballast and the track to settle further and thus make the condition still worse. All water which collects in this manner must soak through the dirt of the sub-grade till it finally finds an outlet. If, however, the surface of the sub-grade were higher in the middle than on the shoulders or even if it were level, the water which penetrated the ballast would find a natural outlet along the top of the more impervious dirt of the sub-grade.

The usual width of roadbed for single track main line is from 18 to 20 ft. and for double track from 30 to 33 ft. For double track therefore, it is even more imperative that the surface of the sub-grade be level, or better yet, slope toward the outside. The American Railway Engineering Association specifies three widths of roadbed, 14, 16 and 20 ft. for single track roadbeds, but common practice seldom allows anything less than 16 ft. The distance from the end of the tie to the edge of a 16-ft. roadbed would be 4 ft.; to the edge of a 20-ft. roadbed would be 6 ft. A specification for a sub-grade should, I believe, require that the middle 10 ft. of the grade be 6 or 8 ins. higher than the shoulder. If the width were made less than 10 ft., the difficulty of laying track would be unduly increased.

Height of Raise, Tamping, Etc.

Surfacing new track differs essentially from raising track on an old bed. Track must be raised high, and because of great inequalities in the solidity of the roadbed, which will cause unequal settling, it is not quite so important that the "top" or surface of the track should be the best obtainable.

Giving the new track a high lift is especially essential if it is down and the mud shows occasionally between the ties. Even the second lift on new truck will not be of much account if it is only 2 or 3 ins., unless the sub-grade is of unusually good quality. Of course care must always be taken not to raise the track so high that sun kinks will occur. With heavy, coarse gravel, there is not as much danger of sun kinks as with fine gravel. Good judgment must be used in putting up the track only so high that the ballast dressed in will be sufficient to hold it in surface and line.

The rule has been generally accepted that tie centres should not be tamped beyond about 15 ins. from the rail, in gravel ballast, the idea being to prevent what is called centre bound track. This rule is undoubtedly a good one in regular maintenance work. There is danger that the centres will be tamped up too stiff, causing poor riding track and broken ties. On construction work, however, full centre tamping is usually advisable. When surfacing is done by contract there is practically no danger of getting the centres too well tamped, and where the lift is high, and the grade new, the settling of the roadbed will be the most serious feature and will entirely overshadow the effect caused by too stiff centre tamping.

While most track men are entirely familiar with surfacing track on an old bed, there are some differences in surfacing track on a new bed which should be brought out, together with a suggested organization.

Distribution of Men and Work Performed

The gang should be organized somewhat as follows, varying the number of men filling in and tamping track as conditions require:

1 spot board man
2 jack hole diggers
6 jack men
4 jack tampers
4 men filling in for jack tampers
1 level board man
1 hammer man
8 men filling ends
16 men tamping ends
8 men filling centres
12 men tamping centres

The spot board man sets up the board from sights made by the foreman or competent assistant, unless sufficient ballast is unloaded to make a complete raise to grade stakes. Two spot boards should be used, and the man sets one spot board in advance and has it ready so there is no delay of the jack men.

Of the three jack men on each jack, two carry the jack ahead and the third carries the jack board ahead (preferably a base plate with a wire handle), and places it in the next jack hole. Extra jack boards and a man to do nothing but place these in advance of the jack men, are sometimes advantageous and increase the amount of work done.

The level man levels up the track and also sets the spot board block back for the foreman to sight across, unless one side of the level is trimmed down to the correct height for a spot board block and is used for that purpose. After the jacks are let off, the hammer man knocks down track by hammering the ties if necessary. He should also carry a spot board block so that the jack men will not have to wait for blocks while a joint is being knocked down.

It is perhaps needless to say that the men around the jacks should be the best men, as the amount of work accomplished depends so greatly upon them.

The foreman should sight from about the same distance back of his jacks each time, and should raise both centres and joints with the spot. It is a waste of time and energy for the jack men to raise the joints first and then double back and raise the centres.

The tampers should be organized to tamp the track in the following manner; if there are four pairs of tampers on the ends each side, have the head pair tamp every fourth tie, the next pair tamp the tie behind that, etc. The centre tampers should follow a similar system. Besides keeping the men at work close together without interference, this method accomplishes two other very desirable conditions, viz.: it makes it possible to get more work out of men who would soldier under the old methods; and more important still, the track as a whole is tamped in a more uniform manner. Under the old method where each pair of tampers was assigned a rail or half rail length, the sections tamped by the better tampers stood up better than the rest. Where the good tamping is mixed with the poor the whole track is more likely to settle uniformly.

A gang of 60 or more men should have a first class general or head foreman, and at least two assistants, one of whom should "follow the jacks," that is, sight the blocks for the actual raising of track; the other should have charge of finishing and lining after track is raised. The general foreman should personally see to all matters pertaining to organization, and to the general conduct of the work. And it will fall to him to see that the tamping is properly done, as his assistants will be kept busy with their duties and unable to look after this very important item. The placing of men is likely to need changing several times every day, for conditions change as the work moves along. For instance, the uneven distribution of ballast may make it necessary to make a change in the line-up. If gravel is unloaded too heavily, which is often the case, the number of jack hole diggers will have to be increased, while the "swampers," or men filling in can be reduced; if the unloading is too light, the swampers are not likely to be able to keep ahead of the tampers. All these things and many others are matters for the foreman to adjust. Highway crossings also force a readjustment of the force, as they have to be planked and graded as soon as they are crossed. The foreman who is "onto" his job can generally spot some man in the gang, usually some old man who has followed track work for years as a means of getting his living and whiskey, who, while unable to keep pace with the younger men at tamping, is worth his wages to look after such jobs as fixing up crossings, and other items like that. The foreman will find that there is enough to keep him busy without having to stand over a crossing that is being put in shape, and will appreciate an old man like this.

The foregoing applies alike to either contract work, or work done by the company forces. Contractors nearly always see the economy of having ample supervision, while on the contrary railway companies are usually averse to having enough assistant foremen to properly look after the work. In these days, the laborers being nearly all foreigners who do not understand the English language, it is absolutely necessary to have more supervision than is usually accorded by the railways if the work done is to be up to the standard it should be.

Costs

The costs given below are in two parts. In the first portion, the rate paid laborers was $2 per day, the work being done in the cool, early spring months, from April 17, to May 28, 1913. The costs in the second part represent totals where the ordinary rate for laborers was $2.25 per day, work done in the summer months from June 7 to October 3, 1913.

The total cost chargeable to track raising during the early period was $5,064 for raising 60,100 ft. of track, average raise 6 ins., with laborers at $2 per day. This total figures out at $445 per mile, including lining and dressing up the track to standard.

The total costs chargeable to track raising during the period with laborers at $2.25 per day, was $7,850 for 74,400 ft., average raise 6 ins., which figures out $621 per mile. This figure includes dressing track to standard.

The average raise was 6 ins. Ballast was good clean gravel, but was too fine to make the best ballast.

It was easily and quickly tamped, however. The track was shovel-tamped only, and was tamped clear across ties, as the softness of the grade precluded the possibility of centre bound track.

Especial emphasis should be given these costs as they give comparison between:

(1) Costs of doing work with $2 labor and $2.25 labor.

(2) Unit costs in the early spring and unit costs in the hot summer months.

(3) The effect on costs of breaking up and reorganizing a gang.

The first gang struck for a raise of wages which was refused. Then new men could not be obtained at $2 per day, so it was necessary to offer $2.25 per day. A very poor class of labor was obtained for the second gang. This was due to the great demand for laborers in the summer months, and the resulting scarcity of good laborers. The gang hired in the early spring was American labor, while many foreigners were included in the second gang.

The difference in quality of laborers obtained on this work bears out very strongly the contention of track men that a much better class of labor can be obtained in the spring than in the summer. The cool weather also has a very marked effect on the costs, as shown in this work.

The effect of breaking in or organizing a new gang is not generally realized by many railway men and contractors. The costs were so much greater that the contractor in this case would have been justified in raising the wages of the old gang to $2.50 or $2.75. Such occurences are all too frequent. An experienced and reliable man is refused a raise, and then it is found necessary to offer a considerable higher salary to obtain even a green man to do the work, frequently one who cannot even approach the efficiency of the former man.

It is safe to assume that the difference in efficiency between the better men obtained in the spring and those obtained in the summer will be at least 25 per cent. The work on the above was 42 per cent cheaper in the spring, but the cool weather was undoubtedly responsible for part of this. It is fair to assume, however, that the old gang would have continued with at least as high efficiency as they had attained, and on this basis the last 12 miles put up at $621 per mile represented a loss of $2,032.

The costs, especially during the early spring, are very low, much below the average of surfacing by railway forces. There are two reasons for this low cost—ample supervision and quality labor. Few railways would allow three assistants and one general foreman at a total of $15.50 per day to supervise a gang averaging about 70 men. The writer's experience would indicate that the usual supervision would consist of one foreman and one assistant, totalling about $6.50 per day, for this size railway company gang. And with this inadequate supervision they pay 25 cts. to $1 less per day for laborers, and get a class of men which is really in greater need of supervision.

There are two other features that attention should be drawn to: (1) The same foreman handled both gangs; (2) Costs in each case include the extra cost of organizing, each gang being made up from new shipments of men.

Comparison of Costs

The conclusions to be deducted from the above are that it is profitable to:

(1) Allow ample supervision—say one assistant foreman to each 25 men.

(2) Hire men as early as possible in the spring.

(3) Pay quality prices and obtain quality labor.

(4) Push the work vigorously in the cool months.

(5) Use every means to retain an experienced and organized gang—it will pay well.

(6) Raise the wages of old men rather than hire inexperienced, incompetent men.

Dual System of Water Supply and Distribution

THE dual system of water supply and distribution has frequently been discussed in technical literature. Whenever the subject has been brought up the more or less obvious disadvantages of the system have been pointed out. The subject is an attractive one apparently, however, and waterworks men show a disposition to revert to it from time to time in their discussions before the several waterworks associations. The latest discussion of the subject was by Mr. Henry C. Hodgkins, of Syracuse, N.Y., in his paper before the recent annual convention of the American Water Works Association. The following matter is abstracted from his paper by Engineering and Contracting.

The daily average consumption per capita for cities in this country will run from 100 to as high as 200 gals. Very few large places will average less than 100 gals. The maximum per capita consumption will run from two to four times the average. The average daily consumption per capita for domestic purposes will amount to from 25 to 30 per cent. of the total average, and the amount required for culinary and drinking purposes will amount to from 3 to 5 per cent. of the total. The amount of potable water thus required is very nearly a constant quantity from day to day. Filtration plants cost from 12 to 20 per cent. of the total cost of the remaining portion of the waterworks in the case of mechanical filters and 20 to 30 per cent. in the case of slow sand filters. In Pittsburg, the estimated cost was 30 per cent. and in Toronto 20 per cent. of the previous cost of the works.

In a city of 100,000 Mr. Leonard Metcalf estimates the cost of that portion of a distribution system due to domestic consumption at 21 per cent., that due to industrial consumption at 32 per cent. and that due to fire protection at 47 per cent. If the division is carried farther that portion due to culinary and drinking purposes would be about 4 per cent.

If the distribution system could be separated into distinct systems and at the above proportionate costs the problem of dual systems would be easy. But such is not the case. The cost of a dual system in terms for a complete system would vary widely, but as a general proposition I think it a fair statement that a separate system to supply the inhabitants of a city with potable water would cost from 25 to 30 per cent. of the distribution system as generally constructed. In other words, that the cost of the dual system would be from 70 to 150 per cent. of the cost of the filtration plant, varying widely according to conditions and according to which system of filtration is used.

There is a wide range in the cost of filtering water. Making due allowance for maintenance of plant, interest and depreciation, the cost would probably fall between 1 cent and 1.5 cents per 1,000 gals. Assuming a cost of 1.2 cents per 1,000 gals., the cost of filtering

1,000,000 gals. per day would be	$12.00
40,000 gals. per day would be	.48
Difference per day due to filtration	$11.52

That is, if instead of filtering all of the water only the portion furnished through the dual system was filtered, the saving in the cost of filtration would amount to $11.52 per million. From this would have to be deducted the interest, depreciation and maintenance of the dual system which in a medium sized city would require not to exceed half of this saving, leaving the remainder for the additional cost of administration and saving to the department.

The pure water should sell at a much higher rate than the raw water for two reasons: first, to provide ample revenue to cover all charges due to the dual system, including service pipes and meters; and second, the price should be high enough to prevent the use of pure water for other purposes than those intended.

These figures are merely illustrative, but they are sufficient to show that the dual system is not impossible from a cost point of view, but that it is entirely feasible and in many instances the solutions of a very difficult situation.

It is not claimed that the dual system should be universally adopted, but in places where there is a supply of naturally pure water sufficient to meet the culinary and drinking requirements, it is urged that it be supplied through a separate system, leaving the larger requirements to be furnished from the nearest and cheapest source of reasonably clean water.

There are many instances where towns have outgrown their water supply. The present supply being excellent in quality, but insufficient in quantity. Just such an instance exists in the writer's practice. The demands have increased beyond the supply and the capacity of the distribution mains. It has been recommended and considered with favor, that a duplicate system covering nearly half of the town be installed, furnishing a water more suitable for manufacturing purposes, but not fit for drinking. The original distribution to supply all of the needs of a portion of the residential section from the original source, and with the smaller mains extended to all parts of the town, supplying all the inhabitants with the excellent drinking water, it being the expectation that as the city grows the dual system would be extended until the entire city is covered.

Because the industrial growth of the town has caused a demand beyond the capacity of the supply, but which is still sufficient for all house supplies for even a much larger town, should the best of nature's supplies be discarded and replaced by a filtered supply?

The difficulties of supplying the ever increasing demand with a potable water are such that all naturally pure waters should be conserved, and it would seem that it is time that the scientific planning of dual systems should be commenced. It is not the purpose of this paper to criticise work that has been done or that is under way; but to emphasize a new departure in waterworks construction and management. There is no reason why the bottled purveyors should have the best of the business. Pure water, like other food products, should be conserved and delivered in the best possible manner.

The great argument against the dual supply has been the difficulty of controlling its use. It has been argued that poor people would use the cheaper water, and that many, especially new arrivals in the city, from ignorance would use the contaminated water. Every precaution should, of course, be taken to prevent the wrong use of either water. The drinking faucets should be of one handsome ornamental design, properly labelled. All other faucets should be of the same and an entirely different and distinctive design. Greater care and inspection of all fixtures would be necessary, which would certainly be progress in the right direction.

In discussing the paper, Mr. Frank C. Kimball related the classic Lawrence, Mass., case as an argument against the dual system. In that case there was a filtered water supply for drinking and culinary purposes. The polluted river water was piped through the mills for ordinary use in washing and similar purposes. The pipes carrying the polluted water were of one uniform color and were labelled. A penalty was imposed on the use of this water for drinking. Despite these precautions the mill operatives drew water from the polluted supply wherever it was more convenient to do so than to draw on the pure supply. This resulted in considerable sickness and several deaths and the polluted supply was abandoned by the mill owners.

Mr. F. W. Cappelen, city engineer of Minneapolis, said that it is the duty of every city to furnish a pure water supply to all its inhabitants. The quality of this supply must be so good that a child can drink it; so that anyone can open a faucet anywhere and be safe in doing so. Every inhabitant must be protected against his ignorance or carelessness. This cannot be done with a dual system.

Specifications for Road Tars

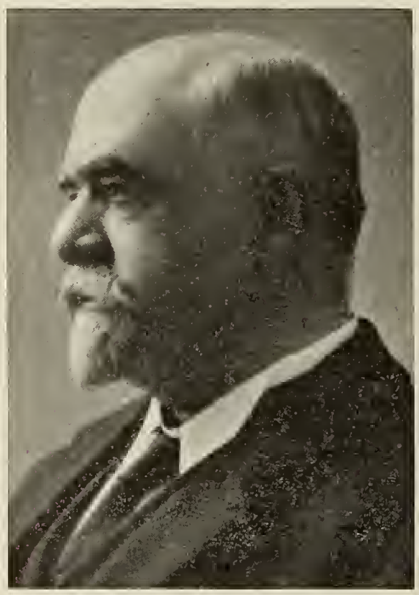
Directions and specifications for the tar treatment of roads issued by the Road Board of Great Britain state that for tar No. 1 (suitable for the surface tarring of roads) the distillate between 170 deg. and 270 deg. C., or 338 deg and 18 deg F. (middle oils), shall remain clear and free from solid matter(crystals of naphthalene, etc.) when maintained at a temperature of 30 deg C. for half an hour. This requirement, however, may be waived in the case of tar supplied direct from gasworks; but tar from which the naphthalene has been extracted is preferable to tar containing much naphthalene. The tar must contain not less than 12 per cent and not more than 21 per cent by weight of free carbon. The free carbon is to be determined by complete extraction with benzol and carbon bisulphide of the bituminous matter from a weighed portion of the tar. The residue left is to be taken as free carbon. Specifications for tar No. 2 (suitable for making tar macadam, and for surface tarring in very hot weather, when the road crust is exceptionally dry) stipulate that the tar may contain not more than 25 per cent of its volume of the tar (or distillates or pitch therefrom) produced in the manufacture of carburetted water gas. The free carbon limit, which formerly was 18 per cent of the weight of the tar, has been altered to not less than 12 per cent and not more than 22 per cent by weight. Prepared pitch from tar distilleries must contain not less than 16 per cent and not more than 28 per cent by weight of free carbon; and commercial soft pitch not less than 18 per cent and not more than 31 per cent. In the latter case the pitch may contain not more than 25 per cent of pitch (formerly 10 per cent) derived from tar produced in the manufacture of carburetted water gas for both tar and tar oils.

The new third lock for the canal at Sault Ste. Marie, Mich., is nearing completion and is expected to be open for navigation within a month. This lock will be the longest in the world, its dimensions being: length, 1,350 ft.; width, 80 ft., and depth sufficient for boats of 24 ft. draft.

Canadian Contractors and Their Work

Mr. S. M. Brookfield, the Halifax Contractor

ONE of the most conspicuous figures in the contracting field of the Maritime Provinces is Samuel Manners Brookfield, President of the general contracting firm of S. M. Brookfield, Limited, Halifax. Mr. Brookfield was born in Yorkshire, Eng., in 1847. His father was John Brookfield, C.E., a war department contractor for some twenty years. The son, Samuel, commenced business with his father as purchasing agent, and was identified with him in the construction of the fortifications at Halifax, the St. John Military Hospital and the Provincial Buildings at Halifax. Upon the death of the father, in 1870, the son took over the business. Following the fire at St. John, N.B., in 1877, Mr. S. M. Brookfield built the Bank of Nova Scotia and other structures. He also carried out much important work at St. Johns, Newfoundland, after the fire which occurred there in 1894. At Halifax he carried out an expeditious contract in building the Academy of Music in the remarkable time of twenty weeks. He built the Sugar Refineries at Richmond and Dartmouth and the cotton factories at Halifax, and he was associated with the well-known Pearson contracting firm, of London, Eng., in the construction of the Halifax graving dock. In 1906 the business was turned into a limited company, of which Mr. Brookfield was made president. Many noteworthy undertakings have been carried out by the new firm, notably All Saints' Cathedral, the new Y. M. C. A., and the North-West Arms Memorial Tower, all at Halifax, and the new Sugar Refineries at Woodside. Mr. Brookfield has many interests outside of his own particular business, but he has been particularly prominent in shipping circles. He was President of the Canada & Newfoundland Steamships Company, whose business was conducted successfully for six years and then sold to the Furness Steamship Company. As Manager of the Halifax Graving Dock Company he was identified with the formation of a salvage firm which released a number of large steamers, including the C. P. R. "Mount Royal" (10,000 tons), and gave a great deal of work to Halifax. For some time Mr. Brookfield sat on the aldermanic bench of his city, and he was also a member of the local School Board.



Mr. S. M. Brookfield, Contractor, Halifax, N. S.

Garbage Collection and Disposal at Vancouver

Interesting details concerning methods of garbage collection and disposal in operation at Vancouver, B.C., are contained in a letter contributed by Mr. B. Wylie, of Vancouver, to Municipal Engineering. Mr. Wylie, who was for a number of years in charge of the garbage department at Vancouver, contributed the information in response to a request for particulars regarding the collection and disposal of municipal wastes. He writes:

The city of Vancouver has a population of 120,000 people and its area is about fifteen square miles. The layout of the city is such that there is an alley in almost every block. This, of course, makes the collection of refuse much cheaper than where everything has to be carried out to the front.

The city owns and operates all its equipment both for the collection and the disposal of all the city wastes.

Some years ago this work was being done by the contract system, but owing to the unsatisfactory service being rendered to the citizens, the city council of that time very wisely put an end to the contract system, and placed the whole system under civic control. The city purchased the equipment which was owned by the contractor, for which they paid him a fair valuation, and by so doing acted fairly and justly with him. Under the contract system there was continual trouble between the contractor and the people to whom he was rendering the service. This might have been no fault of the contractor. The fault lay more with the city for having let the work out by contract, when they themselves should have kept it under their own control.

The city has now over 70 vehicles in the garbage department, consisting of single-horse carts, double teams, and large motor trucks. The single carts are used mostly in collecting from the residential districts of the city, the large wagons in the collection of ashes and such like, while the motor trucks are used in cleaning up the down-town district where the garbage and refuse is heavy.

The garbage is collected once a week in the residential districts, and every day from hotels and the business section of the city. The department will go to any part of the city when called upon, but the party ordering the vehicle has to pay for the charge, which is governed by by-law. From the residential section of the city there is no limit placed upon the amount of garbage that the city will remove, the only restrictions being, that the refuse must be placed in galvanized receptacles which must be kept covered and free from liquids. The garbage is removed free of cost from all residences and the cost is taken from the general revenue of the city. All business houses and such like have to pay the department for any services rendered, according to the amount of work performed.

This city has an inspector in each district. These districts are subdivided into beats so that each teamster has his own beat to look after, and should any complaint come into the office, the inspector can at once find out who is at fault, as he knows the number of the man working on the beat at the time the complaint came in. The inspectors report daily to the head foreman, who has charge of the whole city under the superintendent. These reports are kept on file in the office for future reference.

This city has two destructors in which all the wastes of the city are destroyed. The destructors have given good satisfaction and do their work effectively and without any nuisance. Both the destructors have steam boilers, but little or no use is made of the steam which is generated, the only use being the heating of the buildings and office around the plants. The calorific value of the garbage being low, would necessitate the purchasing of fuel in order to keep a steady supply of steam. With coal at $7 per ton this was considered out of the question.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

Two head gates at the entrance to the Welland Canal are reported to have been torn away by a collision on the part of a freight steamer entering the waterway on July 27.

The Education Commissioners of Montreal have had plans prepared by architects Doucet & Morissette, for the construction of a girls' school at an estimated cost of $200,000.

Good progress has been made so far on the construction of the new filtration plant at Montreal, the cost of which will approximate $160,000. The general contractors, F. J. Jago & Company, have the foundations in.

At Montreal, Que., plans are in progress preparatory to the construction of a stadium on Pine avenue, for McGill University, at an estimated expenditure of $100,000. Messrs. Nobbs & Hyde, Montreal, are the architects.

Tenders are to be called immediately by the Dominion Government for the construction of a new lock on the Trent Canal at Bobcaygeon. The site for the structure has already been purchased by the Department of Railways and Canals.

An apartment house is to be erected shortly on St. Catherine and Glen streets, Westmount, Que., at an estimated outlay of $275,000. Messrs. Audit & Cherbonneau are the architects of the structure, which will be erected for O. Lamoreaux.

A $200,000 by-law for permanent street improvements and the construction of sewers was voted on a few days ago by the ratepayers of Sherbrooke, Que. The by-law was defeated. The result is said to have given rise to a good deal of controversy.

The township council of Barton, Ont., have in contemplation the construction of a sewerage and water works system likely to involve an outlay of $500,000. The work, if carried out, will likely be in the hands of Mr. J. B. Nicholson, Township Engineer.

The firm of Wilson, Townsend & Saunders, engineers and contractors, Toronto, have secured the contract, at about $35,000, for the masonry and concrete work in connection with the Strachan avenue bridge, Toronto. The retaining walls will be 225 ft. long and there will be two heavy masonry abutments.

C. E. Deakin, Limited, Montreal, have obtained a contract for the construction of a Catholic orphanage on Decarie avenue, Notre Dame de Grace, plans for which have been drawn by Mr. Alphonse Piche, Montreal. The building will be of stone and brick, with concrete floors, and is estimated to cost $175,000.

Hamilton City Council are extending the city's sewerage system in the east end at an expenditure of approximately $175,000. The scheme will include 2,400 ft. of 30-in. sewer to the disposal works; 3,100 ft. of 4 ft. 6 in. sewer on Burlington street; and a new pumping station on Gage avenue at a cost of about $53,000.

Four new brick kilns, which are under construction at the new plant of the Mount McKay Products Company, are almost completed by the contractor, Mr. Claude Smith. The plant is at present turning out about 20,000 bricks a day, and when running at full capacity, according to Mr. Smith, the daily output will be increased to 70,000 bricks in addition to products of terra cotta and tile.

The construction of a breakwater extension in front of the Port Arthur harbor is well under way. The breakwater will be 2,500 feet long and 30 feet wide, with a block, 40 feet wide, at the end for the accommodation of a lighthouse. The extension consists of twenty-five cribs, 100 ft. in length. Piles have already been driven for fifteen cribs.

Four sets of plans for the projected high-level bridge at St. Catharines, Ont., have been supplied by Mr. N. S. Sprague, consulting engineer, of Pittsburgh. The plans, which embrace four different designs, are under consideration by the Bridge Committee of the Council, who are expected to take definite action in the matter at an early date.

Building returns for the past half year in Montreal show that the number of permits taken out is greater for the first six months of the present year than in the corresponding period in 1913. This is due to the fact that more dwellings and buildings of the smaller type are in course of construction this year. For 1914, from January to June 30, the estimated value of new buildings was $8,521,910, against $9,942,286 in the same period in 1913.

The Toronto Board of Control has referred the tenders for the construction of a Registry office on Elizabeth street, Toronto, at an estimated cost of $400,000, to Property Commissioner Chisholm, the City Architect, and Mr. C. S. Cobb, architect, for a report. The contracting firms tendering for the general contract are Fred Holmes & Son, Peter Lyall Construction Company, Norcrosse Brothers, and John H. Parker, Canada, Limited.

In a letter to the Mayor of Ottawa, Messrs. Hazen & Whipple, engineers in charge of the preparation of plans for the Ottawa River water supply, state that these will be ready for submitting to the Provincial Board of Health for approval by the middle of August. The plans upon which the engineers are working are for the construction of a purification plant on the site designated by the City Engineer, Mr. A. Currie, in a recent report.

A press report states that the Stanley Works, of New Britain, Conn., said to be the largest steel good manufacturers in the world, have acquired a large interest in the Canada Steel Goods Company, of Hamilton, Ont. The carrying out of these arrangements will probably be followed by the location of a big plant in Hamilton for the firm's Canadian and export business. The plans for the extension call for the erection of large rolling mills and the installation of new machinery.

The five-million-dollar good roads scheme promoted by the Ontario Government is having a marked influence on the highways of new Ontario, judging by a report made a few days ago by Roads Commissioner Whitsun, of the Provincial Government, upon his return from a tour of inspection of the northern part of the province. The new highway between Rainy Lake and the mouth of the Rainy River is progressing rapidly. The Port Arthur and Fort William road is being stoned and gravelled and new highways cut into the Pigeon River country, connecting Fort William with the Minnesota State road, which latter leads to Duluth and is one hundred miles long. The trunk road between

North Bay and Mattawan, a distance of about fifty miles, is completed. The eighty miles of road from Sault Ste. Marie to Algoma Mills will be open for traffic this season and the trunk road from Sydney to North Bay will be completed within a year.

An extension to the elevator capacity of Montreal is in contemplation by the Harbor Board, the purpose being to construct an addition to their No. 1 elevator, which will supplement the present capacity by a million and a half bushels. The elevator already has a capacity of two and a half million bushels, so that when the new addition is completed it will be one of the largest elevators on the continent. The cost of this extension is expected to approximate $750,000. It will be of the same type as the extension at the east side of the original No. 1, with concrete tanks. The plans are being submitted to the Department at Ottawa and when approved tenders for the work will be called in order to have the new elevator completed by September.

The girder concrete bridge over the Yarmaska River, for the Montreal and Southern Counties Railway, has just been completed by the contractors, Messrs. Ross & McCombe. There are two massive piers and two abutments, each of the three spans being eighty feet in length. As the river at St. Cesaire, where the new bridge is located, contains a quick-sand bottom the piers are to be constructed on piles, of which eighty, having a length of from thirty-five to forty feet, were sunk under each of the four substructures. About two thousand yards of concrete was used for the piers and one thousand cubic yards of rip rap was put into the foundations. The Hamilton Bridge Company were the contractors for the girders of the bridge, which will cost in the vicinity of $75,000.

Dietrich, Limited, Montreal, have obtained a contract for constructing a drainage system at Drummondville, P.Q., at a cost of $32,000. This will be a combination system for sewage and water, which will have an outlet in the St. Francis River. At present there is a system on the lower level of the town, and the work to be carried out will apply to the upper level. The drains will be of tile up to 27 in., and above that of concrete. A large amount of roadway is also to be constructed. The same firm are carrying out water and drainage systems at Parent, Fitzpatrick and Doucet, three divisional points on the Transcontinental Railway. Dietrich, Limited, have also been awarded the contract for a street lighting and conduit system at Lachine, P.Q., for which Messrs. Dupont, Roy and Baudouin, Montreal, are the engineers.

Work on the construction of the new Union Station for Toronto has commenced. Preliminary work includes the erection of a board fence around the Front, Bay and Yonge street sides of the site and excavation has been started. The foundation for the erection of the field office, at the corner of Bay and Front streets, is in course of excavation. This temporary building is intended for the accommodation of engineers, architects, and office staff. On behalf of the Board of Architects, Mr. H. Ferguson, who had charge of the building of the Chateau Frontenac, Quebec, and the Grand Trunk depot in Ottawa, will supervise the work. The P. Lyall Construction Company, who are the general contractors for the construction of the station, will be represented by Mr. Griffith. The cost of the buildings will be approximately $2,000,000.

Messrs. George Anderson & Company, Limited, of Carnoustie, Scotland, the parent firm of George Anderson & Company of Canada, Limited, Montreal, have just been successful in securing two very large contracts. The first for eleven wharf cranes for the Port Commissioners of Calcutta, was secured in the face of strong competition with all the leading crane makers of Great Britain and Europe. The firm, who have supplied cranes of all types all over the world, send only the ironwork to foreign countries, the lumber being supplied at the site, thus reducing the freight charges to a minimum. The second contract, which was also secured, in the face of very strenuous competition, is for eight large gas engines and suction gas plants for the Hirosima irrigation scheme in Japan. These engines are designed for continuous running on a very small quantity of fuel which, in this case, is charcoal.

WESTERN CANADA

Sketch plans are in preparation by the architect, Mr. J. H. G. Russell, in connection with the projected construction of a Children's Home at Tuxedo Park, Winnipeg, at an estimated cost of $300,000.

The Board of City Commissioners of Edmonton has created a new municipal position, that of General Inspector over every department of city work. The first inspector to be appointed is Mr. A. J. McLean, at a salary of $3,000 a year.

Work on the construction of a reservoir for the City of Regina has commenced and a large gang of men is employed on the excavation. The new reservoir, the capacity of which will be five million gallons, will be located on a site to the north-east of the old power house.

A report from Ottawa conveys the information that the United States government, which is building the Alaska railroad at a cost of $35,000,000, will extend the line from the Yukon territory into northern and central British Columbia, connecting with the main line of the Grand Trunk Pacific.

At Regina, Sask., the R. C. Episcopal Corporation has taken steps towards the erection of a block of workmen's cottages at a cost of about $100,000. The houses will contain seven rooms and bath, and will be heated by hot-air furnaces. Water and sewer connections will be installed by the city and the work of construction is expected to employ at least three hundred men.

The Canadian Northern Railway has just placed an order with the Canada Car & Foundry Company, the Hamilton National Steel Car Company, the Crossen Car Company, and the Preston Car & Coach Company, for more than one-and-a-half-million dollars worth of equipment for the company's service between Toronto and Winnipeg, by way of the new line from Port Arthur to Sudbury.

The Department of Public Works has commenced operations on the construction of a new dock at Port Coquitlam, B.C., alongside the mill of the Coquitlam Shipbuilding and Marine Railway Company. The new dock, which is to replace the old structure, will extend much further into the river. The approach will be three hundred feet in length, with a "T" 40 ft. by 40 ft. in size, on which will be erected a freight shed of 16 ft. by 24 ft. dimensions.

The steel work has been completed on the extensive plant of the Saskatchewan Bridge & Iron Company, at Medicine Hat, Alta. A railway spur was constructed recently and seven car loads of iron and brick have been shipped to the factory site. The buildings will represent an investment of approximately $100,000, and when the plant is in full working order employment is expected to be provided for about one hundred men.

The construction of a new picture theatre at the corner of Rose street and 11th avenue, Regina, has been completed at a cost of about $50,000. The building is mainly of brick and a circular entrance, surmounted by a dome, forms an imposing front. The decorative work, which is said to be unique as well as artistic, was carried out by a Chicago firm. The architects for the theatre, which has seating capacity for about one thousand people, were Messrs. Tripp & Rowley, of

Regina. The contract for the construction of a new Empress theatre in Regina has been awarded to Mr. T. R. Davidson, of Regina.

Engineers of the Dominion Public Works Department hope to complete this fall the survey of the Saskatchewan River, on which they have been engaged for three years. They are planning a new means of transportation in the form of a 5 ft. waterway from the Rockies to Winnipeg, which would be sufficient for barge traffic. The cost is estimated at approximately $15,000,000, the principal items of expenditure being a series of locks along the river.

The rural municipality of Assiniboia, Man., is contemplating the installation of three separate systems of sewerage and waterworks in the east half of the municipality, and it is reported that the cost of the scheme will approximate $500,000. As briefly referred to in the Contract Record of July 22, the present intention is to sink wells in order to furnish a water supply, but as this municipality comes within the scope of the Greater Winnipeg Water Scheme a supply will eventually be provided from the latter source. Engineers are at present working on the necessary preliminary surveys, which will probably take two or three months to complete. Mr. G. W. Rogers of Kirkfield Park post office, is the municipal engineer-in-charge.

Canadian Railroad Development

Mr. W. J. Bowden, Chief Engineer of the Department of Railways and Canals, has left Halifax on a tour of inspection of the work on the Hudson Bay Railway terminals at Port Nelson. He will also superintend the installation of twelve light ships along the shores of Hudson Bay.

The work of completing the National Transcontinental Railway will, it is expected, be completed and the line ready for operation in October. By that time the car ferry, which was constructed in England, will be in position for the conveying of trains between Quebec and Levis. This will provide a through connection for the whole line of the Transcontinental Railway. About 1,100 men are said to be employed upon the construction work at the present time.

Work upon the Alberta and Great Waterways Railway, now under construction from Edmonton to Fort McMurray, is advancing steadily, according to a recent report made by Mr. R. W. Smith, chief engineer, who has made an inspection of the line as far north as Lake La Riche, accompanied by Mr. Norman L. Harvey, Secretary of the Provincial Department of Railways, and Mr. E. H. Ellison, Divisional Engineer. It is expected that the grade will reach the lake this fall.

It is estimated that the work of double-tracking the entire line of the Canadian Pacific Railway will involve an outlay of more than $100,000,000. The undertaking is to go on continuously from year to year until the whole system is double-tracked. It is not the intention of the company to proceed with the double-tracking along the Thompson and Fraser rivers until 1915, by which time the Kettle Valley line will be ready for traffic and an alternative route thus provided.

Plans which have been prepared by Messrs. Warren & Wetmore, architects, provide for the construction of an up-to-date building of steel and concrete, for the new passenger station about to be erected for the Canadian Northern Railway Company on a site at the corner of St. Montique and Lagauchetiere streets, Montreal, pending the construction of permanent terminals. The building will be two storeys above and one storey beneath street level. It will have a frontage of 150 feet with a depth along St. Montique street of about 100 ft. The facade of the new depot will be of stucco with marble columns. The cost of the structure, which is to be completed next May, will approximate $250,000.

The C. P. R. is said to have expended during the past two years approximately two and a half million dollars in improvements on the Dominion Atlantic Railway, which is now virtually part of the Canadian Pacific Railway system, although not yet formally taken over. The largest individual work was that of the Bear River bridge, which necessitated an outlay of one and a half million dollars. Other new bridges are those across the Avon, at Windsor, over the Gaspereau River and at Weymouth. When this road is brought up to the regular standard and taken over by the C. P. R., it is anticipated that the run from Halifax to St. John, N.B., will be reduced to about six hours.

Personal Mention

Mr. Ross H. McMaster, of Montreal, has been appointed a director of the Steel Company of Canada, in succession to the late Senator Gibson.

Mr. Gerald Ponon, C.E., of Calgary, Alta., has been investigating the various systems of roadbuilding in England during the past few weeks.

Mr. Thos. Turnbull has been appointed Assistant Chief Engineer of the Canadian Northern Railway, with headquarters in Winnipeg. Mr. Turnbull, who is a native of Ontario, was formerly connected with the C. N. R., and for the last four years was with the Canadian Pacific and the Hudson Bay Railroad.

Mr. W. C. Brennan has been appointed works commissioner of Fort William, Ont., in charge of construction and maintenance of roads and sewer work, etc. Mr. Brennan was formerly secretary of the Department of Public Works, Hamilton. He has held similar positions in various parts of Canada for the past twenty-four years.

Mr. D. Howard Martin, C.E., has been appointed Chief Engineer with the firm of Messrs. Jas. H. Corbett & Sons, Kittaning, Pa., contractors for Section 5 of the new Welland Ship Canal, with headquarters at Allanburg, Ont. Mr. Martin recently filled the position of Divisional Engineer of the Pittsburgh and Shawmut Railroad, Brookville, Pa.

Mr. W. P. Dobson was recently appointed Director of the Experimental Laboratories of the Hydro-Electric Power Commission of Ontario. Mr. Dobson has been carrying on research work within the last two years on the electrical disturbance in high tension transmission systems for the University of Toronto Engineering Alumni Association.

Mr. Ralph Modjeski has been retained by the Burrard Inlet Tunnel and Bridge Company of British Columbia, to report on tenders which the company received some time ago for the construction of the Second Narrows Bridge, Vancouver, at a cost of about $2,000,000. Mr. Modjeski is a well-known consulting engineer in Chicago, and a member of the board of engineers of the Quebec Bridge.

In accordance with the Good Roads Act in Canada, the following provincial appointments are announced in the Manitoba Gazette: Chief Engineer, Mr. M. A. Lyons; Engineers, Messrs. S. A. Button, T. T. Wilson, J. B. Phillips, W. Youngman, R. Whitside, and F. Minnville; Assistant Engineers, Messrs. W. R. Bertram, L. Cote, W. H. Bladock; Inspector, Mr. H. T. Thornby; Draughtsman, Mr. C. W. G. Milne.

Mr. J. S. Meadows, who has been in railroad work for fifty-seven years, twenty-seven of which have been in Canada with the G. T. R., celebrated his golden wedding in Toronto a few days ago. Mr. Meadows is a native of Northamptonshire, Eng. He gained expert knowledge of engineering and was amongst those chosen to build the Triumphal Arch on London Bridge for the arrival in London of Queen Alexandra. He was also engaged in the building of an underground railroad in London from King's Cross to Farringdon Road. He was afterwards employed as Construction Superintendent in various parts of Great Britain. His work in the Grand Trunk service was chiefly on the auxiliary in wrecks.

Sir Sandford Fleming, whose re-election for another term of three years as Chancellor of Queen's University, Kingston, took place recently, has held that office continuously since 1880, in which year he became Chancellor of the University. In 1887 he was elected to the presidency of the Royal Society of Canada, receiving his K.C.M.G., ten years later. His distinction in engineering was attained when he filled the position of Chief Engineer during the construction of the Canadian Pacific Railway. He has written a large number of scientific works dealing with subjects of practical interest to engineers.

Mr. T. R. Perkin, formerly Assistant Manager at Toronto of the Pedlar People, Limited, manufacturers of sheet metal products, has been transferred to the Winnipeg office as the firm's western manager. Mr. Perkin, who has already taken up his new duties, has been with the Pedlar People, Limited, for many years and his promotion to this position is a recognition on the part of the firm of his capability as a salesman.

After spending several days inspecting terminals and terminal plans in Toronto, Montreal, Boston and New York, the Chicago Railway Terminal Commission sailed on July 14 for a six weeks' study of European railway terminal facilities.

Trade Notes

The Fibred-Asphalt Paving Company, of Canada, has been formed with head office at 9 Front Street E., Toronto, to manufacture fibred asphalt—a new pavement, for the manufacture of which patents have been secured in Canada, the United States, and several European countries.

A Canadian branch of the Independent Pneumatic Tool Company, whose works are at Aurora, Ill., has been opened at 334 St. James street, Montreal. Mr. W. H. Rosevear, who was formerly connected with the London Concrete Machinery Company as Winnipeg representative, is the manager. The Independent Pneumatic Tool Company are manufacturers of the "Thor" line of pneumatic tools, which include drills and hammers.

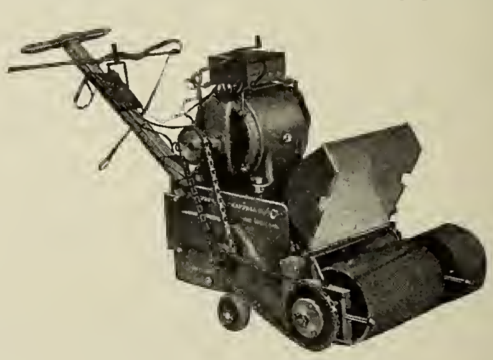
The Galt Wire & Ornamental Iron Company, Limited, a new company whose headquarters are at Galt, Ont., are taking up the manufacture of a general line of ornamental iron and wire goods, specializing in grille work for banks, offices, etc., metal lockers, elevator enclosures, wire guards, and railings. The firm have also installed an up-to-date plating plant which leaves them in a position to handle any kind of brass, bronze or copper oxidized finishing. The plant consists entirely of new machinery and the necessary facilities therefore are at the firm's disposal to do a large volume of business. The General Manager, Mr. John Spalding, is a thoroughly practical man, having been for a number of years in charge of the grille department for the Otis-Fensom Elevator Company, Hamilton, Ont.

The application and influence of mechanical draft form the subject of two interesting catalogues issued recently by the B. F. Sturtevant Company of Canada, Limited, Galt, Ont. The various conditions it meets are described in Bulletin No. 178, in which the adaptability of the appliance to local conditions and its success in reducing power cost is clearly demonstrated. Bulletin No. 199, which is also before us, describes in detail the Sturtevant "Monogram" fan. This fan, so-called because of the monogram "B. F. S." cast into the casing, bears the hall mark of efficiency. The company already have installed over 68,000 of these fans. They are built either as blowers or exhausters, in four discharges, either right or left hand, and are adapted for direct connection to electric motors, or steam turbines. They can also be belt-driven from engine, motor, or counter shaft.

Wire Reinforcement for Brick Work

There has just been placed on the market a new type of wire reinforcement for brick work for which several advantages are claimed. This reinforcement consists of four parallel strands of No. 7 B.W.G. galvanized steel wire of high tensile strength, tied together by means of crimped bands of galvanized hoop steel placed about 8 inches apart. The fabric is 2½ ins. wide and is finished in rolls of 75 ft. It is claimed that this reinforcement will make ordinary brick work monolithic and that it can be used with safety in place of steel beams or arches over openings. The building by-laws of Montreal and Winnipeg permit of certain reductions in thickness of brick walls, where reinforcement of a suitable type is used. For instance, the cost of a 12-in. wall will be reduced 20 per cent if reinforcement is used. The cost of this fabric, in place, in ordinary work, including labor and material, is about $5.50 per thousand bricks; the actual labor cost being 50c per thousand. It is claimed that a saving of from $10 to $15 per thousand brick can be effected by using this wire fabric. Mr. W. Sharp, of Francis Hankin & Company, Montreal, is the patentee of this new product which will be sold under the trade name of "Mono" brick reinforcement. Patents have been applied for in all countries. Francis Hankin & Company, Coristine Building, Montreal, are the Canadian sales agents.

The Automatic ball-bearing, electric floor-surfacing machine, manufactured by Wayvell Chappell & Company, 4845 Ravenswood Avenue, Chicago, Ill., illustrated herewith, is becoming very popular amongst building contractors and floor layers. It is claimed that this machine rapidly refinishes old floors, taking off old varnish, paint, shellac, etc., and that it will also dress quarter-sawed oak, maple, etc., in any manner required. Solidly built, all heavy parts accurately assembled, the machine is fitted with heavy steel ball-bearings on all running parts so that the cutting roller and the two 9-in. diameter suction fans, to which the dust sack is attached, spin true and easy. The roller may be either flexible for easy adjustment to floor inequalities or rigid to level the floor quickly. It is claimed to be the only machine having a mechanism to brake the machine for easy work and to gauge the depth of the roller cut. This brake gauge, the bottom of which is of polished wood, gauges the depth of cut by holding firmly the handle in any position by means of a small lever. The surfacing machine is made in several sizes, suitable for small rooms or large areas.



Automatic floor-surfacing machine.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brampton, Ont.

Tenders will be received until August 10th by the town council for the construction of sewers. Plans are at the office of the engineer, Mr. Wm. Treadgold. The estimated cost is $13,750.

Barrie, Ont.

The necessary by-law having been passed, the plans have been drawn by the town council for the construction of glazed sewer tile pipe on James, Ross and Sophia streets. The engineer in charge is Mr. K. S. Macdonell.

Calgary, Alta.

A by-law providing for the expenditure of $80,000 on extensions to the waterworks system will be submitted to the ratepayers on August 14th.

Dewar Lake, Sask.

The Rural Municipality of St. Elmo No. 291 have been given power to borrow the sum of $6,000 for road building purposes. Mr. Sam Finley is the secretary-treasurer.

Hamilton, Ont.

The city council has decided on the construction of the following drains:—Beulah Court, South St., $510; Rosslyn Ave., $502; Balmoral Ave., $566; Leeds St., $408; Clinton St., $433.

The work in connection with the East End Sewerage System consists of 3,100 ft. 4 ft. 6 in. sewer on Burlington St., $47,678; 541 ft. 8 ft. x 6 ft. sewer on Wallace St., $13,375; 815 ft. 6 ft. x 5 ft. 2 in. sewer on Wallace St., $13,159; 300 ft. 4 ft. sewer on Gertrude St., $2,571; 230 ft. 5 ft. sewer on Burlington St., $3,500; 2,154 ft. 33 in. x 30 in. sewer on Ottawa St., $20,073; 2,400 ft. 30-in. sewer to Disposal Works, $25,000; new pumping station, Gage Ave., $53,000.

Lunenburg, N. S.

Tenders will be received by R. C. Desrochers, secretary to the Public Works Department, until 4 p.m., August 18th. for dredging a channel 200 ft. wide to depth of 18 feet, sand and clay 110,000 cu. yds. Plans are at the department, Ottawa.

Mitchell, Ont.

The town council will construct a sewer on Main St., and the construction of a number of other sewers is under consideration.

Ottawa, Ont.

Plans have been drawn and surveys made for the construction of pavements on Thornton street, between Bank and Ralph streets. The approximate quantities are: tarvia surface 2,790 sq. yds; gutter 1,727 lin. ft.; headers 95 lin. ft.

The city council proposes to lay tarvia macadam pavement on Gilmour street between Bank and Elgin streets.

Orillia, Ont.

Tenders for machinery supplies under sections E, F and G of the waterworks specifications will be received by the town council until August 24th. Chairman, Mr. E. Long. Engineer, Mr. W. K. Greenwood, West Street.

Regina, Sask.

Tenders are invited by the Works Department for the supply of two sections of 510 feet each, one section 100 ft. long and one section 120 feet long, sidewalk railings, posts and fittings, for the Broad street subway.

The Board of Highway Commrs. has had surveys made for draining lands in Twp. 33, Range 11, west of 2nd mer., at an estimated cost of $6,159.

Tenders for the construction of additional filter beds at the sewage disposal works will be received by the Commrs. until August 15th. Plans and specifications are at the office of the engineer, Mr. F. McArthur.

St. John, N.B.

The city council proposes that a six-inch main be laid in conjunction with the Marble Cove sewer extending from Kennedy Street to the head of Rowans wharf.

The city council is about to call tenders for the construction of pavement on Orange St. between Carmarthen and Wentworth streets.

Strathroy, Ont.

The town council proposes to construct concrete pavement on Front St., from Thomas St. to Maria St. The work is to be done this summer.

Toronto, Ont.

Tenders close on August 18th with the Board of Control for sewers on 9 streets nad West Toronto Sewer System Div. No. 2 Outlet. Plans are at the office of the Works Department.

Toronto, Ont. (Bond Lake)

Tenders are wanted by the Imperial **Realty Investments, 123 Bay Street,** Toronto, for grading a tract of land at Bond Lake.

Winnipeg, Man., Charleswood

The ratepayers refused to endorse the by-law calling for the expenditure of $60,000 on road construction.

CONTRACTS AWARDED

Blenheim, Ont.

The contract for construction of sidewalks has been awarded by the town council to Messrs. Leitch & Tift, Blenheim, at 12¼c per ft. for walks, and 15½c per ft. for crossings.

Calgary, Alta.

The following contracts for the supply of water meters have been awarded by the city council. Walsh & Charles, 450 Travellers Bldg., Winnipeg, 40 trident disc meters at $16.38 each; 10 trident 2-in. style 3, at $65.00 each; National Meter Co., 19 No. 9 2-in. Nash, at $65.00 each, 100 No. 9 1-in. Nash, at $21.80 each; Western Supply & Equipment Co., Calgary, 10 Sieman meters, at $10.70 each.

Chatham, N.B.

The town council has awarded to the Carritte Paterson Co., of St. John, N.B., the contract for the construction of 6,000 yds. tarvia pavement.

Edmonton, Alta.

The following paving contracts have been awarded by the city council. The National Paving Co., of 1st St., for 10,000 sq. yds.; The Crown Paving Co., of 487 Kinnaird St., for 11,000 sq. yds. The work is to start at once.

Fullarton, Ont.

Mr. W. B. McFarlane, of Thamesford, Ont., has secured the contract for dredging in connection with the construction of the Flat Creek drain.

Humboldt, Sask.

The town council has awarded to Theodore Kipp & Co., the contract for the supply and installation of pumping machinery and accessories for pump house, at $12,350.

Montreal, Que., Lachine

A contract for paving has been awarded by the city council to the Bithulithic Paving Co., Ltd., of 745 St. Catherine W., Montreal.

Montreal, Que., Pt. Claire

The contract for the construction of sewers and water mains has been awarded by the town council to Laplante & Belanger, of Lachine, at $6,324.62.

New Westminster, B.C.

The city council has let the contract for the paving of Columbia Avenue to the Hassam Paving Co., Ltd., of Hart Block.

North Sydney, C.B.

The Carrite Paterson Co., of St. John, N.B., has secured the contract for the construction of tarvia pavement.

Port Colborne, Ont.

The town council has awarded to Andrew Goebel, of Humberstone, Ont., the contract for the construction of 1,300 yards concrete walks and crossings. Walks, $1.03 per sq. yd.; crossings, $1.40 per sq. yd.

Regina, Sask.

The city council (waterworks department) has awarded half the water mains contract to Jno. Brodt, Dominion Trust Bldg. The remaining half will be done by the department by day labor.

The city council has awarded the following contracts: The H. W. Laird Co., Ltd., of 2338 Dewdney St., 275,000 sewer brick, $12 per M.; Economy Foundry Co., Ltd., of 407 Donalda Block, Winnipeg, 225 manhole covers and frames, $16 each; Canada Metal Co., of Winnipeg, 6,000 lbs. oakum, $276.

Senneville, Que.
The municipal council has awarded to A. Thibauckan the contract for the reconstruction of 4½ miles main highway, the construction of 14 reinforced concrete pipe culverts, and a reinforced concrete bridge, 20 ft. span x 25 ft. wide. Bermudery Lake Rd. asphalt is to be used.

Stamford, Ont.
The contract for the construction of concrete sidewalks has been awarded by the township council to P. Lorenza, of Niagara Falls Centre, at 7c per ft.

Toronto, Ont., Mimico
The town council has let the contract for the construction of the sidewalk on Station Rd. and Albert St., to Mr. Arthur Lyttleton, at $1,780.

Vancouver, B.C.
Vancouver & Districts Joint Sewerage and Drainage Board has awarded to Messrs. Hodgson, King & McPhalen Bros., of 319 Pender St. W., the contract for the construction of the trunk sewers.

South Vancouver, B.C.
The contract for the paving of 34th avenue has been secured by the Columbia Bitulithic Co., Ltd., of Dom. Trust Bldg., Pender St. W., Vancouver.

Watrous, Sask.
The Little Manitou Rural Telephone Company has awarded a contract to the Prince Albert Elec. Co., Ltd., Prince Albert, for the construction and supply of material for a telephone system.

Railroads, Bridges and Wharves

Province of Alberta
The Edmonton, Dunvegan & B. C. Railroad Company proposes to lay rails westerly from Sawridge in the direction of Smoky River, which point will be reached shortly. Bridges will be built over the Peace and Smoky rivers this winter. The 930 ft. bridge over the Athabasca river is nearly completed. The J. D. McArthur Company, of Winnipeg, has the contract.

Dist. of Algoma, Ont.
The Electro Metallingical Co., of Welland, Ont., has filed plans for the construction of a wharf on East Neebish Island.

Bobcaygeon, Ont.
Tenders for the local section of the Trent canal close with Mr. L. K. Jones, Department of Railways and Canals, Ottawa, on August 17th. Plans are at the office of the Chief Engineer of the Department, Ottawa, and the superintending engineer, Peterboro.

Co. of Middlesex, Ont.
Mr. Chas. Talbot, County Bldg., London, the county engineer, is preparing plans for 2 bridges: one 35 ft. span across creek on 2nd St., the other, 60 ft. span across Mud Creek, on the road between McGillivray and East Williams.

East Chezzetcook, N.S.
Tenders for extensions to breakwater at Graff Beach will be received by R. C. Desrochers, secretary of the Public Works Department, Ottawa, until 4 p.m. August 31st. Plans, etc., are at the offices of the District Engineers at Halifax and Antigonish, with Postmaster, East Chezzetcook, and at the Department, Ottawa.

Gulliver's Cove, N.S.
Tenders for the construction of a breakwater will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 31st. Plans, etc., are at the offices of the District Engineers at Halifax and Antigonish, with Postmaster at Digby, N.S., and at the Department, Ottawa.

Hamilton, Ont.
Tenders for the construction of harbor improvements will be received by R. C. Desrochers, Secretary to the Public Works Department, Ottawa, until 4 p.m. August 31st. Plans and specifications at the offices of district engineers, Confederation Life Bldg., Toronto and Windsor, with Postmaster, Hamilton, and at the Department, Ottawa. The work includes construction of wharf 406 ft. long by 50 ft. wide, and stone and gravel approach about 125 ft. long.

Kensington, Ont.
Tenders for wharf construction will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 31st. Plans, etc., are at offices of the District Engineers, at Sault Ste. Marie and Confederation Life Bldg., Toronto, with the Postmaster at Desbarats, Ont., and at the Department, Ottawa. The work consists of rock-filled timber crib covered with plank decking, 96 ft. long x 20 ft. wide x 20 ft. high, rock-filled roadway approach 100 ft. long x 18 ft. wide.

Ottawa, Ont.
Tenders will be received by Mr. L. K. Jones, at the Department of Railways & Canals, Ottawa, until August 25th, for the supply of 2,500,000 barrels Portland cement. Specifications, etc., are with the Purchasing Agent of the Dept., at Ottawa.

Quebec, Que.
The construction of a 150-ft. steel bridge of cantilever substructure at Stadacona road is proposed by the city council. The engineer is Mr. W. D. Baillarge, 50 St. Louis street.

Saskatoon, Sask.
Plans have been filed at the office of the Registrar of Land Titles, for a traffic bridge across the South Saskatchewan River.

Ste. Anne de Saguenay, Que.
Tenders for the construction of extensions to the wharf will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m., August 31st. Plans, etc., are at the offices of District Engineers at Chicoutimi and Quebes, and at the Department, Ottawa.

Tillsonburg, Ont.
Tenders for the construction of a reinforced concrete arch at Oxford street are now being received by the engineers in charge, Messrs. Jas. A. Bell & Son, of St. Thomas.

Winnipeg, Man. (St. Boniface)
Tenders for the construction of the bridge superstructure have been received from the Manitoba Bridge & Iron Works, $252,223, and the Dominion Bridge Co., $264,707. These have been referred to the Public Utilities Commission to decide upon.

CONTRACTS AWARDED

Baden, Ont.
Contracts have been awarded by the Wilmot Twp. authorities for the construction of culverts and bridge abutments to Eichler & Huehn, Jacob St., New Hamburg, $4.83 per cu. yd., and to Alex. Fraser, New Hamburg, $4.93 per cu. yd.

Beauport, Que.
The dredging contract has been awarded by the Public Works Department to The W. J. Poupore Co., Ltd., of 400 McGill Bldg., Montreal.

Carnduff, Sask.
The Provincial Government Board of Highway Commissioners has awarded a contract to W. Lee, of 2164 Scarth St., Regina, for the construction of two reinforced concrete abutments for the bridge over South Antler Creek east of Sec. 6, Twp. 3, Range 22, W. 1st Meridian.

Cheverie, N.S.
Mr. Mortimer Parsons of this town has secured the contract for the construction of the wharf extensions.

Maquapit Lake, N.B.
The Public Works Department has awarded the dredging contract to the New Brunswick Constr. Company, of St. John, N.B.

Montreal, Que.
The contract for the construction of underground conduits has been let by the Electrical Commission to Mr. L. A. Herdt, City Hall.

Ottawa, Ont.
The following contracts on the Bank street bridge have been awarded by the city council: Steel, the Dominion Bridge Company, Sparks Street, $32,784; erection, the Dominion Bridge Company, Sparks Street, $9,990; substructure, R. Brewder, 317 Lyon Street, $22,753.

Priceville, Ont.
The following bridge contracts have been let by the Artimesia Twp. authorities: Steel work, Stratford Bridge Co., Stratford, $1,075; concrete, U. L. Weber, Stratford, $1,875.

Puslinch Twp., Ont.
Mr. H. E. Croft, of Guelph, has secured the contract for the construction of "Paddock's" bridge.

Province of Saskatchewan
The Provincial Government, Board of Highway Commissioners, has awarded to W. Lee, of 2164 Scarth St., Regina, the contract for the construction of two reinforced concrete abutments for the bridge over Souris River in Section 31, Twp. 1, Range 2, W. 2nd Meridian.

Rainy River, Ont.
The contract for pile protection work has been awarded by the Public Works Department to W. J. Sims, of Mac-

Laren St., and R. A. Bingham, of 22 Baird St., Ottawa.

West Vancouver, B.C.
The municipal council has awarded bridge contracts to Naylor Bros., of Room 202 Bank of Hamilton, W. Vancouver, 25th St. bridge, $33,200; Bruce Bros., of 709 Dunsmuir St., 5th St. bridge $5,000.

Public Buildings, Churches, Schools, etc.

Assiniboia, Man.
The ratepayers will be called to vote on August 8th on a by-law proposing the expenditure of $50,000 on the purchase of a site and the erection and equipment of a school building.

Amherst, N.S.
Tenders for the erection of a post office on Victoria Street, will be received by the secretary to the Public Works Department, Ottawa, until 4 p.m., August 24th. Plans, etc., are at the office of Mr. Wm. Bishop, Superintendent of Buildings, Halifax, at Public Building, Amherst, and at Department, Ottawa.

Barrie, Ont.
Tenders for interior fittings at the post office will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m., August 17th. Plans and specifications are at the office of T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, with Mr. E. Sevigny, Caretaker, Barrie, and at the Department, Ottawa.

Brampton, Ont.
Tenders for interior fittings at the post office will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m., August 17th. Plans, ets., are at the office of T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, with Mr. Jos. Foster, Caretaker, Brampton, and at the Department, Ottawa.

Beaver Mines, Alta.
The erection of a public school building is being considered by School Dist. No. 3134. J. T. Moore is the trustee.

Bothwell, Ont.
Plans for the erection of a town hall are being prepared by Mr. W. G. Murray, of Greene Swift Bldg., London. The building will be a three-storey one of brick construction, and will cost about $15,000.

Cowley, Alta.
The erection of a public school building is being considered by the Olin Creek School Dist. No. 3135. K. Johnson of this town is the trustee.

Duncan, B.C.
Working plans and specifications are being prepared by Mr. E. G. Burleigh for the erection of a city hall.

Dunstable, Alta.
The erection of a public school building is contemplated by the local school board. The trustee is Mr. J. B. Nixon.

Exeter, Ont.
The Public Works Department has purchased a site on Main street for the erection of a post office. Plans have been prepared for a building estimated to cost $30,000.

East Angus, Que.
The Protestant Board of School Commissioners have purchased a site for the erection of a school building.

Guelph, Ont.
It is proposed to erect a collegiate institute on the Paisley street campus, at an estimated cost of $125,000. The question will be submitted to the ratepayers during the coming fall.

Hamilton, Ont.
The question of the proposed new jail has been brought up in council by Ald. Garson, who suggests purchasing a new site in the west end for the necessary building.

London, Ont.
Funds are being raised for the erection of a church for the Italian Roman Catholic community.

Montreal, Que.
It has been decided to alter the plans for the National Amateur Athletic Association Club House, and tenders will be called shortly by the architects, Messrs. J. A. Ouellette and J. O. Turgeon.

Plans are in progress and tenders will be called shortly by the secretary to the Board of Commissioners for the erection of city stores and garage.

Messrs. Nobbs & Hyde, architects, Old Birks Bldg., will receive tenders shortly for the erection of the "Bancroft" school on St. Urbain street.

Montreal, Que., Lachine
Tenders are invited by the architect, Mr. Dalbe Viau, 76 St. Gabriel street, Montreal, for the erection of a fire station. The estimated cost is $15,000.

Tenders for a second fire hall will be received by the architects, Messrs. Benoit & Girard, Southam Bldg., Montreal.

Montreal, Que., Verdun
Specifications are being made for the erection of a club house for the Verdun Athletic Club. The architect, Mr. D. J. Spence, of 46 Beaver Hall Hill, will call tenders shortly.

Montreal, Que. (Maisonneuve)
The plans for the erection of the Maisonneuve Methodist Church have been revised and the architects, Messrs. Peden & McLaren, of 20 St. Alexis St., will call tenders shortly.

Oakville, Ont.
Messrs. Gordon & Helliwell, of Confederation Life Bldg., Toronto, have drawn plans for the erection of a Sunday school for the Methodist Church on Dunn street. The cost is estimated at $15,000.

Oakland, Man.
The ratepayers will be asked to vote on a by-law providing for the erection of school buildings at an estimated cost of $8,000. Sec.-treas., Mr. W. T. Johnson, Nesbitt, Man.

Ottawa, Ont.
The University Club of Ottawa, 150 Elgin street, proposes to erect a club house on Gloucester street at a cost of $40,000. The site has not yet been purchased.

Port Colborne, Ont.
The Board of Education contemplate the erection of a school building at a cost of $10,000. Further information can be had from Mr. F. U. Noble.

Port Stanley, Ont.
Tenders for the erection of a warehouse on West Pier will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m., August 31st. Plans, etc., are at the offices of District Engineers at Confederation Life Bldg., Toronto, and Windsor, with Postmaster at Port Stanley, Ont., and at Department, Ottawa.

Pembroke, Ont.
Tenders will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. August 12th, for fitting the interior of the post office. Plans and specifications are at the office of Mr. T. A. Hastings, Station "F," Toronto, Mr. H. Church, Pembroke, and at the Department, Ottawa.

Stamford Twp., Ont.
The architect, Mr. C. M. Borter, Main street, Niaagra Falls, Ont., is receiving tenders for the erection of a $9,000 school building for School Section No. 5.

St. Catharines, Ont.
Tenders for the erection of a new parish hall for St. Thomas' Anglican Church, will be received by the architect, Mr. A. E. Nicholson, 26 Queen St.

Toronto, Ont.
The Board of Control propose to erect two fire halls in the northwest part of the city. The sites are not yet selected.

The secretary-treasurer to the Board of Education will receive tenders until noon August 11th, for the erection of a manual training and domestic science building at the rear of Winchester street school.

Mr. Chas. Grimwood, of 144 Beaconsfield Ave., wants prices on construction for a school at Bond Lake, a theatre on St. Clair Ave., and a residence on Melgund road.

Mr. W. C. Wilkinson of the Board of Education will receive tenders until noon August 11th, for plumbing and heat regulation at Withrow Ave. School; cabinet work at Malvern High School, and electric wiring, plumbing and local telephones at sundry schools. Specifications are at the office of Supt. of Bldgs., City Hall.

Messrs. R. Chalkley & Son, 34 Victoria St., want prices on different trades for Civic Car Barns on Danforth Ave.

Tenders on the erection of "Forrest" school, in High Park, will be received by Mr. W. C. Wilkinson, of the Board of Education, until noon August 11th. Specifications are at the office of the Supt. of Bldgs., City Hall.

Tenders on the erection of a 12-room school on Leslie St., north of Danforth Ave., will be received until noon August 11th, by Mr. W. C. Wilkinson, secretary to the Board of Education.

Winnipeg, Man.
Mr. J. H. G. Russell, of the McArthur Building, is preparing sketch plans for the erection of a Children's Home in Tuxedo Park. The estimated cost is $300,000.

(Continued on page 80)

Tenders and For Sale Department

Tenders for Concrete Sidewalks

Sealed tenders, marked "Tenders for Sidewalks," will be received by the undersigned up to three o'clock p.m. of **Saturday, the Eighth day of August, A.D. 1914**, for the construction of about four thousand lineal feet of concrete sidewalks in the Village of L'Orignal.

Plans and specifications may be seen at the office of the undersigned at L'Orignal, Ontario.

Every tender must be accompanied with an accepted cheque for $200, which will be forfeited in case the tenderer fails to enter into a proper contract (with sureties if required) within ten days after being notified of the acceptance of his tender. Where tender is not accepted, cheque will be returned as soon as contract is awarded.

The lowest or any tender not necessarily accepted.

Dated at L'Orignal this 20th day of July, A.D. 1914.

COLIN G. O'BRIAN,
29-30-31 Village Clerk.

Tenders for the Construction of a Bridge on the Don Section of the Bloor St. Viaduct

Tenders will be received, by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Monday, October 5th, 1914**, for constructing across the Don Valley a bridge consisting of five steel arch spans, with piers and approaches; the width being eighty-six feet, and the length, approximately sixteen hundred and eighteen feet. Bidders may obtain specifications, including plans and form of tender, on application to the Commissioner of Works, Toronto, after paying to the Commissioner of Works twenty-five dollars for each set, this sum to be refunded upon return of plans. The Engineer's Estimate of Quantities will also be sent on request. Specifications, including plans, may be seen at the offices of the Commissioner of Works, Toronto; the Commercial Intelligence Department of the Board of Trade, London, England; the Engineering News, New York; Engineering and Contracting, Chicago; and Engineering, London, England.

Those desiring to submit tenders on reinforced concrete construction for the above bridge, are hereby notified that they may prepare and submit, without any expense whatsoever to the City, their own plans and specifications, based on the loading given in the specifications for steel construction, and may tender on the same. These tenders will be received up to noon on Monday, October 5th, 1914.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering, as prescribed by City By-laws must be strictly complied with, or tenders may be declared informal.

A deposit in cash, or a marked cheque, equivalent to 2½ per cent. of the amount of the tender, payable to the order of the City Treasurer, must accompany each tender, which deposit will be retained until provisions of by-law 4294 are complied with.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto, July 21st, 1914. 30-33

Greater Winnipeg Water District

Tenders for Aqueduct Construction

Sealed tenders addressed to the undersigned will be received up to noon of **Saturday, 19th September, 1914**, for the construction of Eighty-five miles of concrete aqueduct in five sections of approximately equal length.

Plans, specifications and form of tender can be secured after July 20th, 1914, by application to the District accompanied by certified cheque for One Hundred Dollars payable to the District, which deposit will be returned upon submission of tender or return of documents.

Bidders may tender on any section or on any number of sections.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,
Chairman of Commissioners
901 Boyd Building,
Winnipeg, Man., July 6, 1914. 30-36

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements (wharf) at Hamilton, Ont.," will be received at this office until 4 p.m., on **Monday, August 31, 1914**, for the construction of Harbour Improvements, being a wharf and approach at the foot of Wentworth Street, in the City of Hamilton, County of Wentworth, Ontario.

Plans and forms of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, Ont.; Windsor, Ont., and on application to the Postmaster at Hamilton, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

Note.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 30, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63872. 31-32

Tenders

Sealed tenders, addressed to the undersigned Secretary-Treasurer of the Corporation of the Town of Richmond, Richmond, Que., will be received up to eight o'clock p.m. on **Friday, the Fourteenth day of August inst., 1914**, for constructing about 37,000 lineal feet of Concrete Sidewalk.

Work to be done according to specifications prepared by A. M. Evans, Highway Engineer, and subject to inspection engineer in charge of the work.

Tenders to be accompanied by an accepted cheque for 10 per cent. of said tender, as a guarantee that the contractor will sign a contract approved of by the Corporation.

Specifications may be seen at the office of the Secretary-Treasurer.

No tender necessarily accepted.

E. F. CLEVELAND,
Secretary-Treasurer.
Secretary-Treasurer's Office,
Richmond, Que., August 4, 1914. 31

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board will be received until

Friday, August 28th, 1914

for

New Building, High School of Commerce

and to

Tuesday, August 11th, 1914

for

New Building, Leslie Street (North of Danforth Avenue)

Forest School, High Park

Manual Training and Domestic Science Building, Rear of Winchester St. School

Withrow Avenue School—Plumbing and Heat Regulation

Malvern Avenue High School—Cabinet Work

Sundry Schools—Electric Wiring, Plumbing and Local Telephones

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, not later than 12 o'clock noon on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted. All tenders must be on revised forms.

W. W. HODGSON,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer
31

Notice to General Contractors

Sealed tenders for the construction of a church edifice, corner St. George Street and Lowther Ave., Toronto, exclusive of excavation and foundation, will be received by the undersigned until 6 p.m., **Monday, August 10th.** Envelopes to be marked "Tenders."

Plans and specifications may be seen August 4th to 8th at Contract Record, 220 King Street West, or Robins, Limited, 105 Victoria Street.

Tenders may be submitted for straight contract or on a percentage basis. Lowest or any tender not necessarily accepted.

A. E. BLAINEY, Clerk,
62 Herbert Avenue, or
First Church of Christ Scientist,
University Ave. and Caer Howell St.
31

Tenders

Sealed tenders, addressed to the undersigned Secretary-Treasurer of the Corporation of the Town of Richmond, Richmond, Que., will be received up to eight o'clock p.m. on Friday, **the Fourteenth day of August inst., 1914**, for the macadamizing of about one-half mile of Bituminous Macadam Road and about two miles of Water-Bound Macadam Road.

Work to be done according to Government specifications and subject to the inspection of the Government Engineer.

Tenders to be accompanied by an accepted cheque to the amount of 10 per cent. of said tender, as a guarantee that contractor will sign contract approved of by Government.

Specifications may be seen at Secretary-Treasurer's office.

No tender necessarily accepted.

E. F. CLEVELAND,
Secretary-Treasurer.
Secretary-Treasurer's Office,
Richmond, Que., August 4th, 1914. 31

Department of Railways & Canals

New Welland Ship Canal

Notice to Dealers in Portland Cement

Sealed tenders, endorsed "Tender for Cement," will be received by the undrsigned up to 10 o'clock on **Tuesday, August 25th, 1914**, for the supply of 2,500,000 barrels of Portland Cement which will be required in the construction of the new Welland Ship Canal, to be delivered as the work progresses, in such quantities, at such places along the Canal and at such times as the Department may require. It is estimated that the total amount will be consumed within the next four years.

Tenders may be submitted for the whole or any portion of the quantity required.

The Cement must be in conformity with the Department's standard specification for Portland Cement. Specifications, forms of tender and full information can be obtained upon application to the Purchasing Agent, Department of Railways and Canals, Ottawa.

The Department does not bind itself to accept the lowest or any tender.

By order,
L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, July 25th, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—64842. 31-32

Sealed tenders addressed to the undersigned and endorsed "Tender for Dairy Building, Experimental Farm, Ottawa, Ont.," will be received until 4 p.m., on **Monday, August 24, 1914**, for the above mentioned building.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Pubthe amount of the tender, which will be forfeited if the person tendering decline to enter into a lic Works, equal to ten per cent. (10 p.c.) of contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 31, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—62965. 31-32

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Campbellford, Ont.," will be received until 4 p.m., on **Monday, August 24th, 1914**, for the above mentioned work.

Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, at the Post Office, Campbellford, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, August 1st, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—64964. 31-32

To Civil Engineers and Contractors.—Technical graduate, age 28, single, experienced in railroad and general construction. First class draughtsman and instrument man, desires position. Apply Engineer, care Contract Record, 119 Board of Trade Bldg., Montreal. 29-30-31-32

Department of Railways & Canals

TRENT CANAL

Bobcaygeon Section

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Bobcaygeon Section, Trent Canal," will be received at this office until 12 o'clock noon on Monday, August 17th, 1914.

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Trent Canal, Peterborough, Ont.

Copies of plans and specifications may be obtained from the Department on the payment of the sum of fifty dollars. To bona fide tenderers this amount will be refunded upon the return of the above in good condition.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque on a chartered bank of Canada for the sum of $10,000, made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering decline entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,
L. K. JONES,
Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, 23rd July, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—64802. 31-32

Situation Wanted

ARCHITECT.—Excellent recommendations as designer, draughtsman, and perspective artist. Reinforced concrete and steel specialist. Address 6 Kinkora Avenue, off MacKay, Montreal. 31-32

Position wanted by reliable waterworks and sewers construction foreman. Good draughtsman; knowledge of transit and level; excellent references. Box 69, Contract Record, Toronto. 31-34

WANTED

Good, smart, healthy mechanic who thoroughly understands the erection of cement buildings, one who knows something about bookkeeping and draughting preferred, and good on detail work, and must be good with figures; also good judge of quality of cement; also understands letting contracts and checking of same so as to get the best possible results. Must be shrewd, with good ability and judgment and of the highest integrity and not afraid of work. State salary and any other particulars. Users of liquors or cigarettes need not reply. Apply Box No. 68, Contract Record, Toronto. 31

Sale of Railway by Tender

The undersigned will receive tenders for the purchase of The Ontario West Shore Railway up to **Saturday, the 15th day of August, A.D. 1914.**

1. The property offered for sale consists of the railway franchise, extending from Goderich to Kincardine, and covering other territory in the counties of Huron, Bruce, Grey, Lambton and Middlesex.

2. The Road is built from the C. P. R. crossing, close to the Town of Goderich, to Kintail. Grading has also been done from Kintail to Pine River. The distance constructed and on which ties and rails are laid is 14½ miles.

3. The material on hand consists of a locomotive, bridge material, rails, bolts, spikes, ties, posts, etc., for the completion of the road and grading same into a running concern between Goderich and Kincardine within a time to be agreed upon with the undersigned Trustee, who is prepared to enter into a contract for the completion of the work and making such other arrangements as may be necessary for the completion of the road.

There will be a reserve bid.

Further particulars may be had from the undersigned, or his solicitors, or Mr. Charles Garrow, Barrister, Goderich, or P. A. Malcomson, Barrister, Kincardine.

Dated at Goderich this 11th day of July, 1914.

THOMAS STOTHERS, Trustee,
Dungannon, P. O.

Proudfoot, Hays & Killoran,
Goderich. 31-32

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharf at Kensington, Ont.," will be received at this office until 4.00 p.m. on **Monday, August 31, 1914**, for the construction of a wharf at Kensington, Algoma District, Ontario.

Plans and form of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers at Sault Ste. Marie, Ont.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Desbarats, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $10.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary

Department of Public Works,
Ottawa, July 30, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—64623. 31-32

Municipalities and others sending in tender advertisements for the Contract Record are requested to bear in mind that these must be in our hands by

Ten o'clock on Tuesday morning,

each week, in order to be published in the issue of the following day.

JUDICIAL SALE

of the Assets of

The Canadian Mineral Rubber Co.

LIMITED

In the matter of the Winding-Up Act, being Chapter 144 of the Revised Statutes of Canada and Amending Acts, and in the matter of the Canadian Mineral Rubber Company, Limited.

Sealed tenders will be received addressed to "George O. Alcorn, Esq., Master-in-Ordinary, Osgoode Hall, Toronto, Canada," and marked "Tenders in the matter of The Canadian Mineral Rubber Company, Limited," up to 2.30 p.m. of Friday, the 18th day of September, 1914, for the purchase of certain assets of the said Company consisting of:—

PARCEL No. 1—Located at Model City, adjoining Montreal, and at Sorel, Que.

Cummer asphalt paving plant, railroad type, and sundry accessories including rollers, concrete mixers, tank cars, tools, etc., etc.

PARCEL No. 2—Located at Winnipeg, Manitoba.

Roofing and flooring material and equipment, paint, pipe-coating, office furniture, safe, etc., etc.

PARCEL No. 3—Located at Calgary, Alberta.

Merriman asphalt paving plant, railroad type, and sundry accessories, including roller, stone crusher, concrete mixers, hoisting engine, tools, asphalt, cobbles, office furniture, etc., etc., together with a certain lease of dredging rights for sand and gravel, the liabilities under which must be assumed by the purchaser.

PARCEL No. 4—Located at Vancouver, British Columbia.

Cummer asphalt paving plant, railroad type, and sundry accessories, including rollers, stone crusher, concrete mixers, hoisting engine, tools, asphalt, rock, office furniture, motor-cycle, etc., etc.

PARCEL No. 5—Located at New Westminster, British Columbia.

Merriman asphalt paving plant, railroad type, and sundry accessories, tools, etc., etc.

PARCEL No. 6—Located at Victoria, British Columbia.

Merriman asphalt paving plant, railroad type, and sundry accessories, including rollers, concrete mixers, graders, automobiles, tools, supplies, office furniture, etc., etc.

PARCEL No. 7—Located in the State of Utah, U.S.A.

Certain claims and mining rights covering a deposit of practically pure bitumen (gilsonite) and bituminous limestone.

Possession. Immediate possession of parcels Nos. 1, 2, 3, 4, 5, and 7 can be given on completion of sale. Possession of parcel No. 6 cannot be given until certain paving at the City of Victoria, B.C., in which the Liquidator is at present engaged, is completed. If, before the completion of the sale, the purchaser requires possession of any parcel, of which possession can be given by the Liquidator, he may obtain same by giving security for the unmatured payments satisfactory to the Master-in-Ordinary of the Supreme Court of Ontario. Tenders must be made on the understanding that inability on the part of the Liquidator to deliver possession of, or transfer the title to any item shall operate as a cancellation of the sale in respect ot such item only, and shall not operate as a cancellation of the sale as a whole. The amount of any allowance to be made in respect of any such item shall be determined by the Master-in-Ordinary of the Supreme Court of Ontario.

Tenders will be received for all parcels en bloc and for each parcel separately.

All rentals, taxes, insurance, water rates, and similar items will be adjusted to the date of the acceptance of the tender.

Full information as to all parcels with inventories of parcels Nos. 1, 2, 3, 4, 5 and 6, and a schedule of the claims and mining rights included in parcel No. 7, and copies ot the Lease referred to in Parcel No. 3, may be obtained from the Liquidator,

NATIONAL TRUST COMPANY, LIMITED, TORONTO, CANADA.

Terms of Payment. Ten per cent. of the amount tendered shall accompany each tender, 15 per cent. on the acceptance of the tender, and the remainder in 3 equal instalments at 3, 6 and 9 months without interest. On receipt by the Liquidator of the final payment, the sale shall be completed. All tenders must be accompanied by an accepted cheque payable to the Liquidator for 10 per cent. of the amount of the whole tender, which cheque will be returned if the tender is not accepted, and forfeited if the tender is accepted, and purchase not completed by the tenderer.

The highest or any tender not necessarily accepted.

The purchaser shall, at his own expense, make whatever search of title he may deem necessary or expedient, and the Liquidator shall not be required to furnish any abstracts or produce any deeds, declarations, or other evidence of title except those in its possession. The purchaser shall have 15 days from the date of acceptance of tender within which to make any objections or requisitions in respect of the title and in case the purchaser shall, within such time make any objection or requisition which the Liquidator shall from any cause, be unable or unwilling to remove or answer, then the Liquidator may (notwithstanding any intermediate negotiations) rescind the sale, in which case the purchaser shall be entitled only to a return of the deposit money without interest, costs or compensation.

The other conditions will be the standing conditions of sale of the Supreme Court of Ontario as far as applicable.

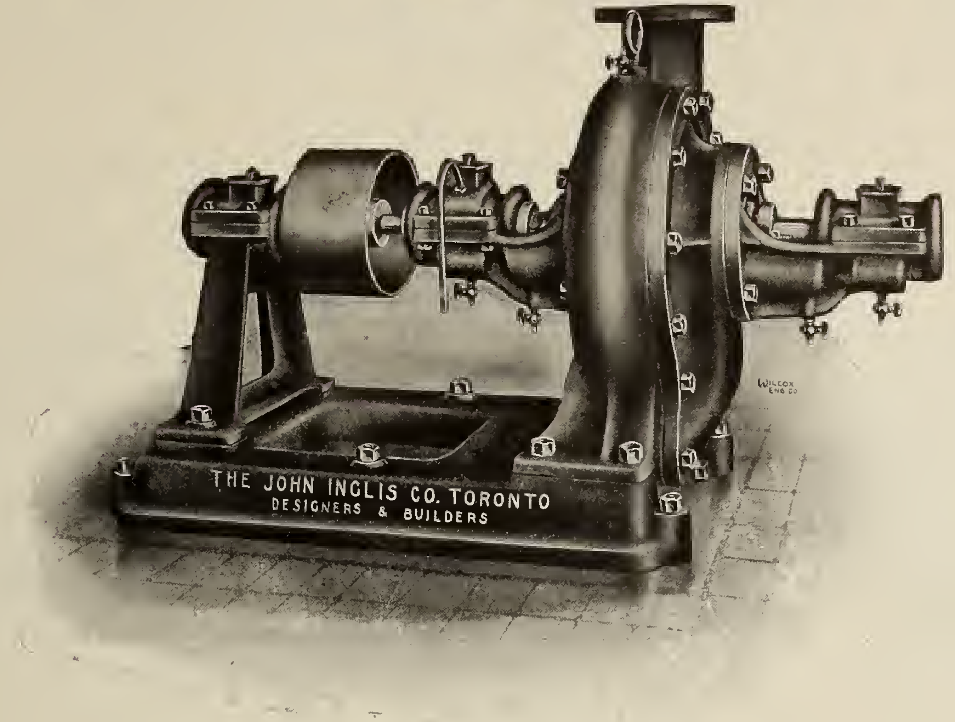
Tenders will be opened at the office of the Master-in-Ordinary, Osgoode Hall, Toronto, Can., at 2.30 p.m., on the 18th day of September, 1914, when all tenderers are requested to be present.

Dated at Toronto, this 10th day of July, 1914.

NATIONAL TRUST COMPANY, LIMITED,
Toronto, Ontario, Canada,
Liquidator.

30-31-33-35

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Machinery and Materials

Sealed tenders, registered and endorsed on the envelope, tender for (tender bidden on) and addressed to H. H. Elliott, M.D., Secretary-Treasurer of the Town of The Pas, will be received up to 6 p.m., **August 11, 1914**, for the supply and delivery of the following machinery and materials.

Tender "A"—For the supply and delivery of two Sewage Lift Pumps.

Tender "B"—For the supply and delivery of Electric House Meters.

Tender "C"—For the construction of Sewage Lift Chamber and Oil Tank Chamber.

A marked cheque for five per cent. (5 p.c.) of the amount of the tender must accompany each bid. The lowest or any tender not necessarily accepted.

Plans and specifications may be seen at the offices of the Consulting Engineers, Saskatoon, Sask.; the Resident Engineer, The Pas, Man.; Contract Record, Toronto, Winnipeg and Montreal, or a complete set of plans and specifications will be given or forwarded on deposit of $25 and a set covering all contracts on a deposit of $50, which deposit will be returned on receipt of a bonified tender and return of specifications. Specifications on House Meters to be obtained from the Saskatoon Office, only, without charge.

H. H. ELLIOTT, Secretary-Treasurer,
The Pas, Man.

MURPHY & UNDERWOOD,
Consulting Engineers,
Saskatoon, Sask.

28-29-30-31

Public Buildings, Churches, Schools, etc.

(Continued from page 75)

Winnipeg, Man., Charleswood
The by-law providing for the erection of a town hall at a cost of $5,000 has been defeated by the ratepayers.

CONTRACTS AWARDED

Chatham, Ont.
The Board of Education has awarded to Messrs. Adams & Adams, of King street west, the contract for the erection of "Queen Mary" school.

Hampton, N.B.
Mr. Ed. Bates, of 73 Duke Street, St. John, N.B., has secured the contract for the interior fittings at the post office.

London, Ont.
A sub-contract in connection with the erection of the Dominion Savings Company's building on King and Richmond streets, has been let to the Luxfer Prism Company, of Toronto.

Montreal, Que.
The following contracts have been awarded in connection with the erection of the Sacred Heart Convent: Excavating, steel and plastering, Jno. Quinlan & Co., 4412 St. Catherine St.; carpentry, D. M. Long, Windsor St., and heating and plumbing, Thos. O'Connell, 187 Ottawa Street.

Moncton, N.B.
The following contracts have been awarded in connection with the erection of St. Bernard's Church Presbytery. General contractor, masonry, carpentry, steel, roofing and plastering, T. D. LeBlanc, Lakeburn St.; painting, Allen McDonald, Downing St.; heating, plumbing and electrical, Sumner Co., Wesley St.

The following contracts have been awarded in connection with the erection of the new church for the parish of L'Assomption, St. George St. General contractor, T. D. LeBlanc, Lakeburn St.; painting, Allen McDonald, Downing St.; heating and plumbing, Sumner Co., Wesley St. Roofing, plastering, electrical and interior fittings not let.

Prince Rupert, B.C.
The School Board has awarded the contract for the erection of the Borden Street school to Mr. John Currie, at $5,850.

Regina, Sask.
The following additional contracts have been awarded in connection with the erection of the Co-operative Elevator Company's building on 12th Avenue. General contractors, masonry and carpentry, Poole & Emery, of Moose Jaw; steel, Manitoba Bridge & Iron Works, of Winnipeg; painting, W. R. Talbot, 2435 Victoria Ave.; heating and plumbing, Forest Bros., 77 High St. W. The roofing and plastering contract is not yet let.

The School Board has awarded the following painting contracts. G. Moors & Co., Ltd., of Albert St., for the Strathcona and Dominion Park Schools; Yamton, Coombs & Co., of 1506 15th Ave., for Albert School.

Trenton, Ont.
The J. T. Schell Company, of Alexandria, Ont., has been awarded the contract for the interior fitting at the post office.

Toronto, Ont.
The following additional contracts have been awarded on Davisville Ave. school by the Board of Education. Masonry, R. Chalkley & Son, 34 Victoria St., $19,423; concrete, Ramsay Contracting Co., 39 Indian Rd. Cres., $1,145; heating and ventilating, J. R. Seager, 799 College St., $4,185.

The following contracts have been let by the Board of Education. Brown School, heating and ventilating, F. Armstrong Co., of 277 Queen St. W., $2,300; Frankland School, heating and ventilating, F. Armstrong Co., of 277 Queen St. W., $2,665; Lansdowne School cupboards, N. S. Houghton, of Manning Arcade Annex, $493; rifle cabinets, Simpson Planing Mills, of Spadina Ave., $1,475.

The following contracts have been awarded in connection with the erection of the Registry Office on Elizabeth St. Cut stone, Oakley & Son, 278 Booth Ave., $93,498; foundation, masonry and fireproofing, J. A Wickett, Ltd., 28 Toronto St,, 38$.957; marble and tile, Missisquoi-Lautz Corp. Ltd., 20 St. Nicholas St., Montreal, $26,600; plastering, W. J. Hynes, Ltd., 720 Dupont St., $17,000; metal sash, Hope & Son, 45 King St. W., $9,925; ornamental iron, G. B. Meadows Co., 479 Wellington St. W., $8,115; roofing and skylight, G. Duthie & Sons, 30 Widmer St., $4,470; metal trim, A. B. Ormsby Co., King and Dufferin Sts., $9,168; heating and ventilating, Purdy Mansell, Ltd., 65 Albert St., $36,999; wiring, Fred Armstrong Co., 277 Queen St. W., $3,200; elevator, Turnbull Elevator Co., John St., $6,190; painting and glazing, Hughes & Co., 884 Yonge St., $10,800. New tenders are to be called on steel work and carpentry.

The following contracts have been awarded on the additions to Huron St. school. Carpentry, Crocker & LeDrew, $8,290; plastering, J. A. Berridge, 518 Manning Ave., $1,994; painting, Jas. Phinnemore, 445 Yonge St., $875; roofing, J. T. Flowers, 200 Markham St., $977; plumbing, R. Jordan, 37 Hazelton Ave., $3,554; heating, Fred Armstrong, 277 Queen St. W., $4,598; stairs, Can. Orn. Iron Co., 88 River St., $984. The masonry contract is not yet let.

Toronto, Ont. (Mimico)
Mr. W. A. Telfer, the local contractor, has secured the contract for the erection of the public library on Station street.

South Vancouver, B.C.
The contract for the additions to General Gordon School has been awarded by the School Board to Mr. W. J. Prout, of 1412 Burrard St.

Victoria, B.C.
The following sub-contracts have been awarded on the erection of the Presbyterian church on Quebec and Fisguard Sts. Carpentry and mill work, Wm. Drysdale, 1033 North Park; steel, Jno. Coughlan & Sons, Pender & Beatty, Vancouver.

Weyburn, Sask.
The following additional contracts have been on the erection of the city and fire hall. Heating and plumbing, Ed. Wordin; electric fittings, David Ross, Weyburn.

The following sub-contracts have been let by the School Board. Heating and plumbing, Geo. T. Walker; electrical fittings, David Ross, Weyburn.

Business Buildings and Industrial Plants

Alma, Que.
A New York syndicate, in which Col. B. A. Scott, of 3 Ste. Genevieve Ave., Quebec, is interested, contemplates developing electric power at Alma and erecting pulp and paper mills at Jonquieres, 20 miles distant. The estimate of the project is placed at $4,000,000.

Edmonton, Alta.
Messrs. Hardy & Maitland, of Victoria Block, are drawing plans for the erection of stores and offices on 6th Ave. for Mr. J. M. Pommarleau. The estimated cost is $75,000.

London, Ont.
Jas. Cowan & Co., of 127 Dundas St., have postponed the building of their proposed warehouse until next spring.

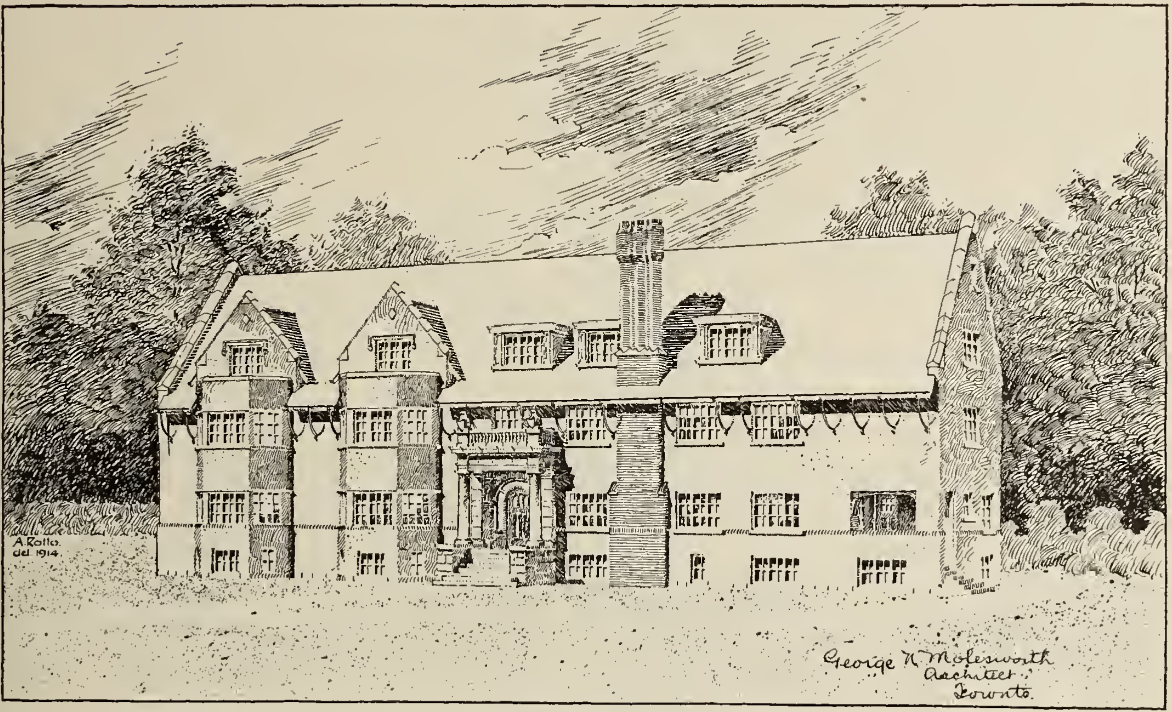
Montreal, Que.
Mr. J. Feldman, of 338 St. Laurent, has obtained a permit for the erection of stores at a cost of $16,000.

Plans have been drawn by Messrs. Nobbs & Hyde, of Old Birks Bldg., for the erection of a stadium for McGill University. The general contractors are Messrs. L. A. Ott & Company of this city.

Ottawa, Ont.
Messrs. A. A. Fournier, Ltd., of Wel-

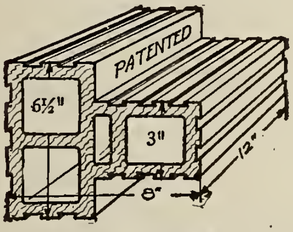
DENISON

Interlocking Hollow Tile



Orphanage for I.O.O.F. **Built like a Thermos Bottle.** Oakville, Ont.

Architect:—Geo. N. Molesworth. Gen. Contractors:—Sutherland Construction Co.



It interlocks.

The one shape and size builds all thicknesses of wall.

Write us for full data.

The One Price Company

Sun Brick Company, Limited

Traders Bank Building

lington St., contemplate the erection of a departmental store on Bank street.

Port Arthur, Ont.
The Bank of Montreal proposes to erect a new bank on the quarters now occupied by "The Bazaar."

Redcliff, Alta.
A contract has been signed whereby the Imperial Brass Mfg. Co., of Chicago, Ill., will build a factory at Redcliff and employ 50 men before winter.

Sarnia, Ont.
It is understood that Hon. W. J. Hanna, who is in England at present, is endeavoring to secure for this city the proposed Canadian branch of a large British smelting concern.

Saskatoon, Sask.
It is understood that Mr. A. Macdonald, of the Macdonald Co., 116 Market E., Winnipeg, will erect a grocery warehouse here. The work may not start until next spring.

Toronto, Ont.
The Toronto Hat Block Company, of 24 Mercer Street, have had plans drawn for the addition of two storeys to their premises.

Victoria, B.C.
Plans are being prepared by T. D. Sedger, 512 Bastion St., for the erection of 16 stores.

Windsor, Ont.
The Windsor Lumber Company, of Cameron Ave. and Wyandotte St., proposes to erect a planing mill as soon as the Hydro system is in use. Up-to-date machinery, driven by individual motors, is to be installed.

CONTRACTS AWARDED

Ottawa, Ont.
The contract for the alterations to Mr. D. H. McLean's premises on Wellington street has been secured by Mr. J. B. Gilbault, of 1070 Wellington street.

The following contracts have been awarded on the erection of a store on Besserer street for Mr. J. P. Featherstone. Masonry, K. McCullough, 181 Waller St.; carpentry, Richards & Co., Eastview.

Regina, Sask.
The contract for the erection of the Western Broom Company's factory has been secured by the local firm of Messrs. Watson & Burbidge.

Toronto, Ont.
The contract for the erection of the Bank of Commerce branch office at Bloor and Lippincott streets has been awarded to Messrs. C. Robertson & Sons, Confederation Life Bldg.

Mr. C. Grimwood, 144 Beaconsfield Ave., has the contract for the erection of a theatre on St. Clair Avenue for Mr. J. Manchester.

The contract for the alterations to the office building at the corner of King and George streets has been secured by Messrs. Geo. A. Fuller Co., 123 Bay St.

Windsor, Ont.
The contract for the erection of the Remington Arms Company's factory has been awarded to the local firm of Messrs. Wells & Gray, Manning House Block.

Residences

Edmonton, Alta.
The client of Messrs. VanSiclin & Macomber, architects, of 314 Alexandra Block, who had under consideration the erection of a $125,000 apartment house, has decided not to build this year.

London, Ont.
Plans for the erection of a $25,000 apartment house on King and Richmond streets for Mr. R. A. Y. Stinchcombe, have been drawn by Mr. A. E. Nutter, of Dundas and Richmond streets, who has also drawn plans for a $7,000 residence on Marley street, for Mr. E. T. White.

Messrs. Watt & Blackwell the local architects are preparing plans for the erection of a residence on Dufferin Ave. for Mr. N. H. Howden.

Montreal, Que.
Permits have been issued to Mr. E. Gagnon, 356 Desery Street, for a $7,000 residence, and to Mr. A. Duquette, 3136 St. Laurent Street, for flats on St. Dominique street at a cost of $30,000.

The erection of Mr. Ross's apartment house on Atwater street has been postponed. Contracts will be let in the fall. Mr. Theo Daoust, 26 St. James St., is the architect.

Recent permits issued include: Jean B. Denteneer, 244 Sherbrooke St. E., residence, to cost $5,000; Mar. Turcotte, 687 St. Urbain St., residence, to cost $5,000; Derault & Laliberte, 97 St. James St., flats, to cost $8,000.

Montreal, Que., Longueuil
The tenders on the erection of Mrs. E. B. Carmichael's residence are being revised, and the contracts will be let shortly.

Ottawa, Ont.
Mr. J. P. MacLaren, of 104 Sparks St., has drawn plans for the erection of a $7,000 residence on Driveway for Mr. Calib Brooks.

Toronto, Ont.
Messrs. Hunt & Woodburn of the Confederation Life Bldg., have drawn plans for the erection of a $7,000 residence on Burlington Crescent, for Mr. I. R. J. Wray.

Messrs. Grimshaw Bros., of 24 Brookmount St., wants tenders on a pair of houses near Queen St. and Kingston Rd.

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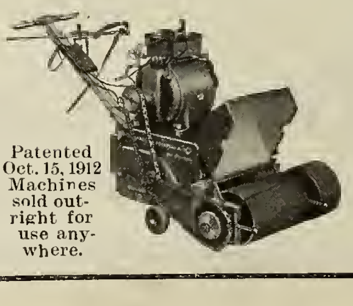
Booklet tells all about it and our



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Made in several sizes for small rooms or large areas.
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CHICAGO, ILL.

Sale of
Quarries, Quarry Plant, Etc.
at Beamsville and Crookston, Ontario

The Trustees of the Estate of the late Honourable William Gibson invite tenders for the purchase of the valuable Quarries situated at Beamsville, 22 miles from Hamilton and 12 miles from St. Catharines, consisting of 94 acres more or less; also at Crookston, 110 miles from Toronto, consisting of 14 acres more or less.

These quarries are those owned by the late Senator Gibson and contain a practically unlimited quantity of the finest limestone and hundreds of thousands of tons of chips suitable for immediate crushing. The Beamsville quarries have a complete tramway system from all parts of it to the G. T. R. Station with valuable franchises, while at Crookston the G. T. R. switch enters the quarry and the C. P. R. is about 500 feet away. Favorable freight rates enable both quarries to compete in the masonry and crushed stone markets of Hamilton, Toronto and Montreal.

Tenders will be received for any or all of the under-mentioned parcels but in the event of parcels 3 or 4 being acquired by tenderers other than the purchasers of the lands the successful tenderers must undertake with the Trustees to remove all the machinery, etc., within three months.

Tenders for parcels 1 and 2 will be considered either on a fixed basis or on a cash payment plus a royalty of so much a cubic yard of stone. The price on a fixed basis will be payable one-third cash, the balance in equal payments at one and two years with interest at six per cent.

Parcel No. 1

Quarry properties at Beamsville owned by deceased with tramway system in connection therewith and being composed of portions of Village lots in Beamsville and of lots in the Township of Clinton in the County of Lincoln, said properties having been conveyed to deceased by deeds registered as Nos. 574 and 304 (Beamsville) 2858, 2509, 2631, 2220, 3558, 2438, 4190, and 5238 (Clinton) and 1259, 1263 and 1268 (Beamsville) with 13 buildings, including office, carpenter and blacksmith shops, engine house, etc. Also three miles of tramway with the existing franchises in connection therewith.

Parcel No. 2

Quarry lands at Crookston containing by admeasurement 14 and 2/100 acres, being composed of part of lot Number Ten in the Ninth Concession of the Township of Huntingdon in the County of Hastings and more particularly described in the conveyance thereof to the said William Gibson dated 21st December, 1896, and registered as No. 5003 (Huntingdon) with all buildings situate thereon.

Parcel No. 3

PLANT AT BEAMSVILLE:

12 hoisting engines with boiler and equipment.
7 power derricks with equipment, masts 65 to 75 ft.
5 pneumatic rock drills.
1 centrifugal pump.
2 Champion road engines.
5 road scrapers.
23 tram cars.
Tools, tool boxes, blocks, pipes, valves, ropes, wires, etc.
16 double drum portable horsepower hoists
4 hand power derricks, masts 18 to 35 feet.
6 blacksmith's forges.
1 sand pump.
1 6 x 16 ft. Blake pattern stone crusher.
3 dump cars.
200 yds. of dressed and partly dressed stone.

Parcel No. 4

PLANT AT CROOKSTON:

2 dynamos.
1 stationary boiler and equipment.
1 single horizontal steam piston pump.
4 derricks.
1 rock drill.
1 hoisting engine with boiler and equipment.
4 horse-driven hoists with equipment.
Pipe, tools, etc., etc.

Detailed inventories may be seen at the office of Mercantile Trust Company of Canada, Limited, in Hamilton or of Messrs. Jennings & Clute, 906-910 Traders Bank Building, Toronto.

A cheque for $500, payable to the Estate of Hon. William Gibson must accompany each tender. The highest or any tender not necessarily accepted.

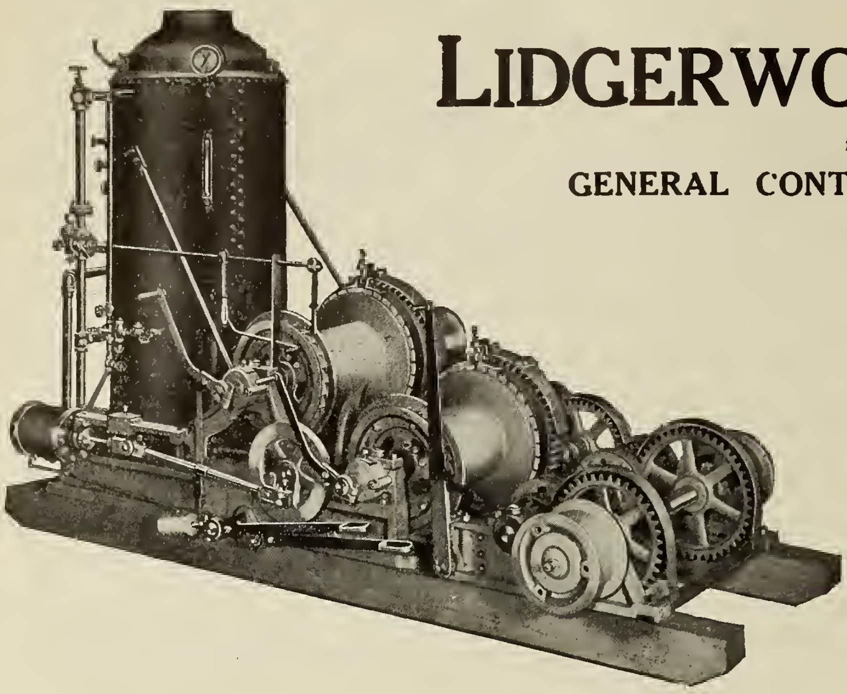
Tenders should be in the hands of the undersigned not later than August 22nd, 1914.

The Trustees reserve the right to sell privately the whole or any part at any time.

Dated at Hamilton this 20th day of July, 1914,

For the Trustees

Mercantile Trust Company of Canada, Limited
Bank of Hamilton Building, Hamilton, Ont.



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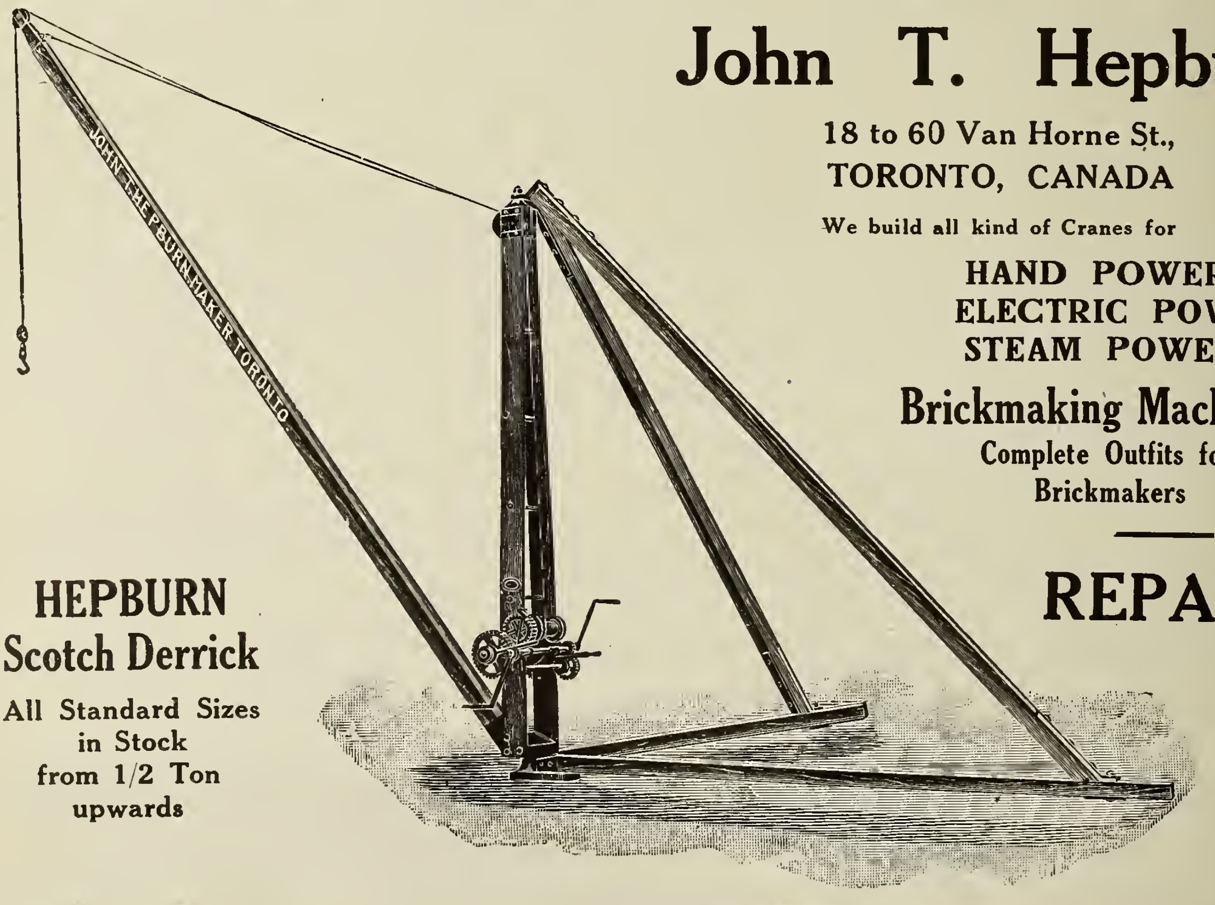
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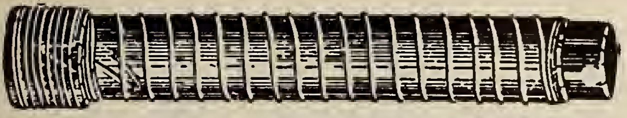
from 1/2 Ton
upwards



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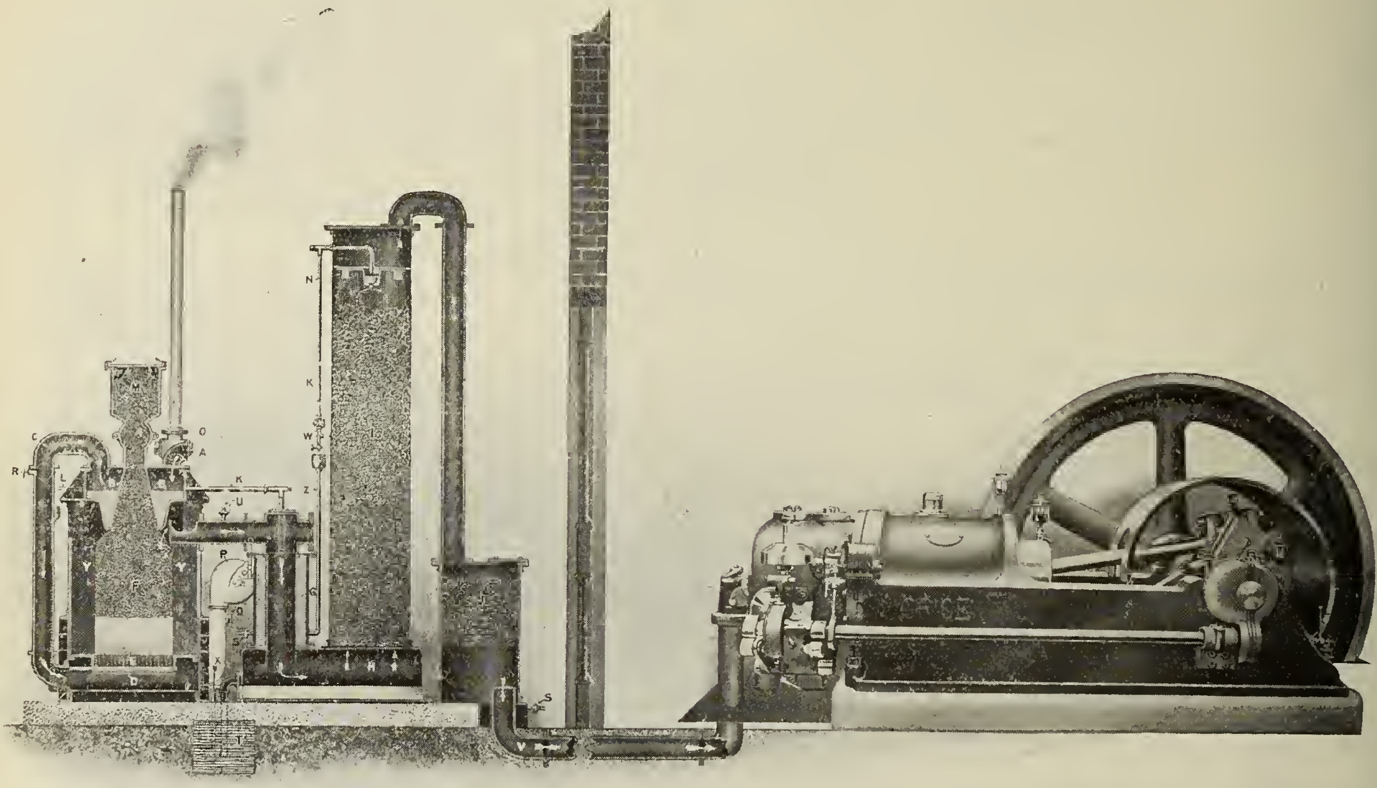

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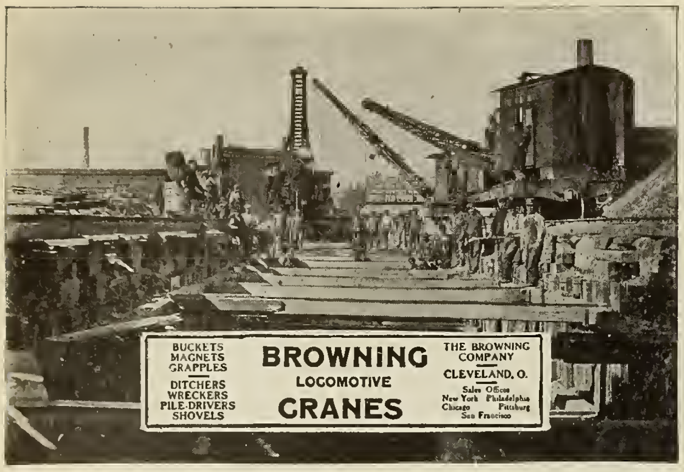
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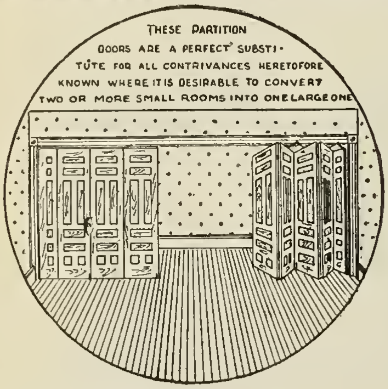
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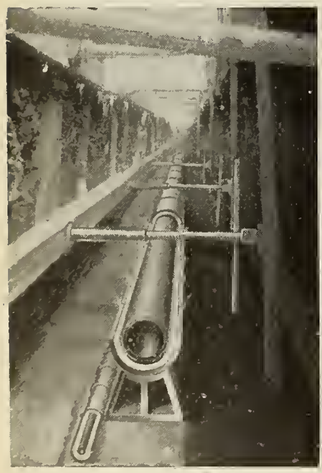
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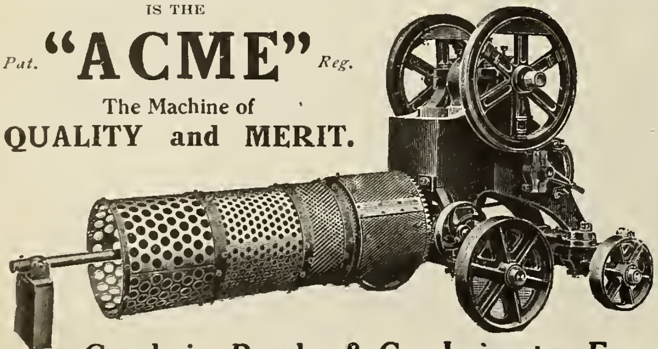

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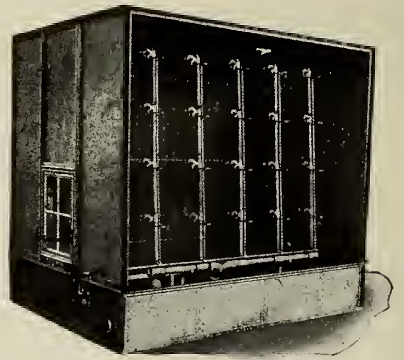

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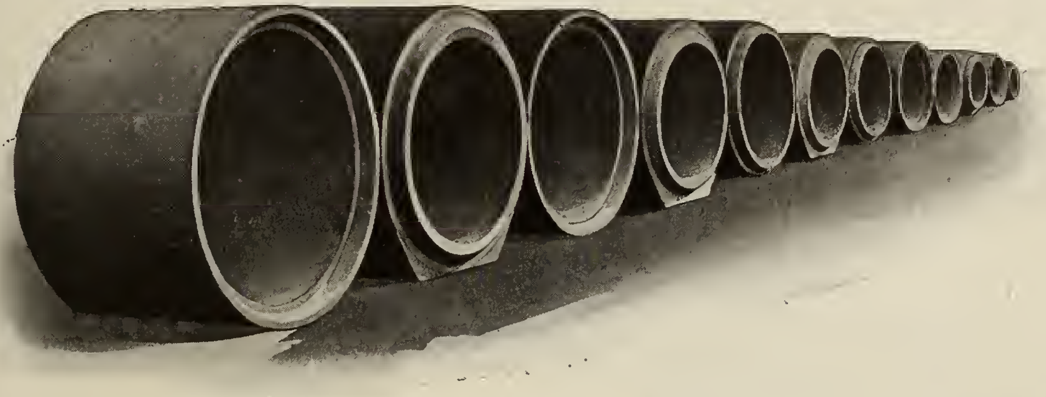

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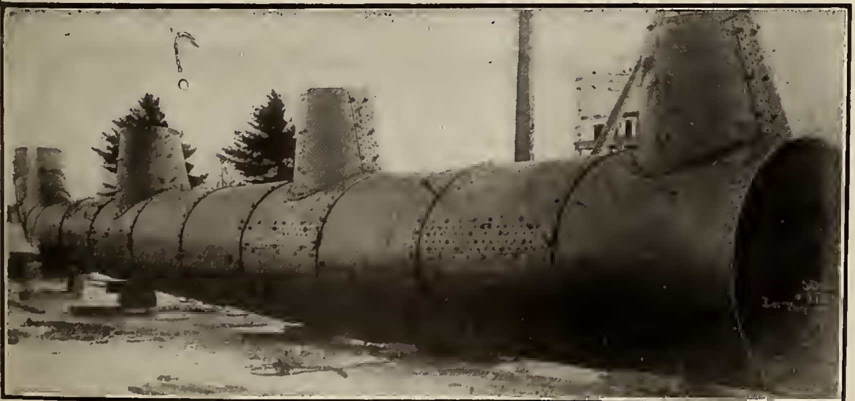

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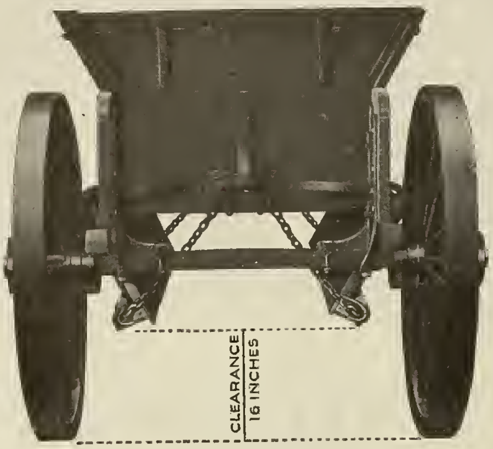

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Ask for further particulars —results of University crushing tests.

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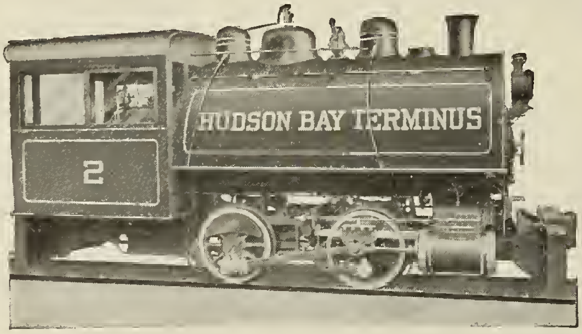

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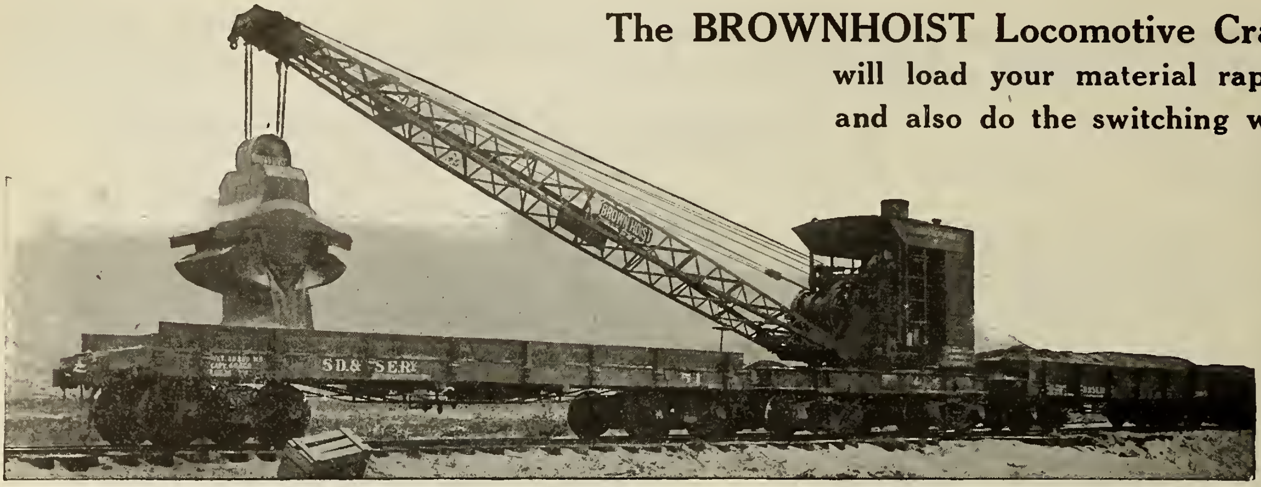
Agencies in all the large cities of Canada.

The BROWNHOIST Locomotive Crane

will load your material rapidly and also do the switching work



15-ton Browohoist Locomotive Crane with Brownhoist Grab Bucket used by the Independent Stone Co., San Diego, Calif.

This crane with the Brownhoist patented grab bucket, handles ore, coal, crushed stone, sand, gravel, etc., 60 to 120 tons per hour. And one man operates the crane. Figure what a saving this would mean in your handling costs. And when you use a Brownhoist crane you are not continually troubled with breakdowns. Ask the owners—they will tell you.

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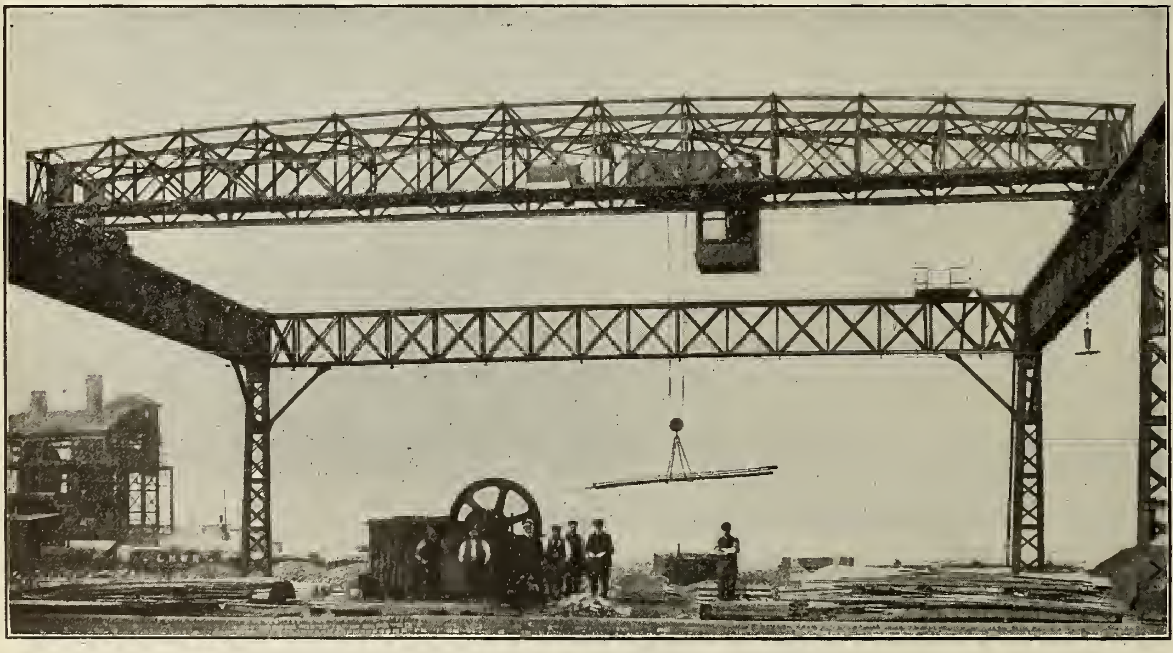

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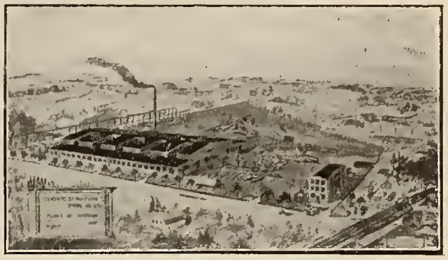

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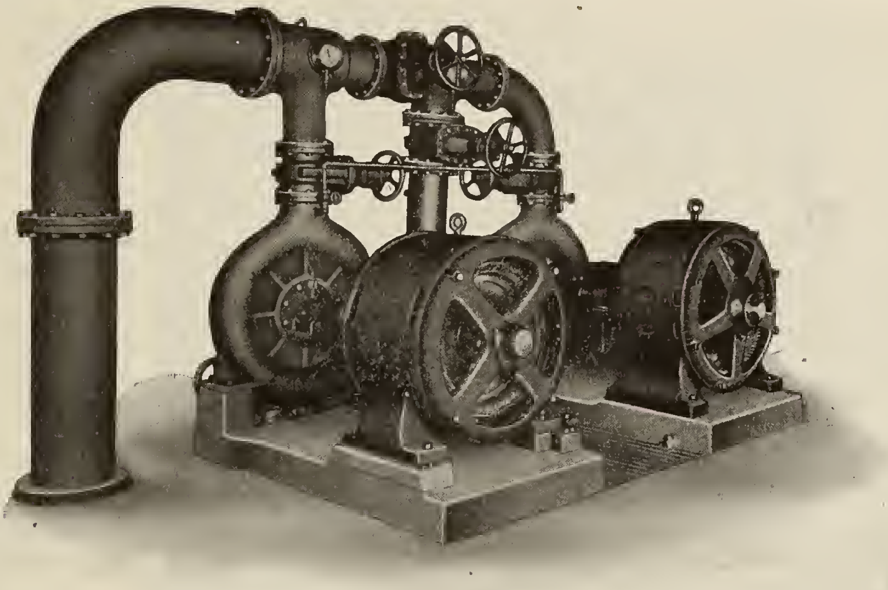
Any capacity or pressure



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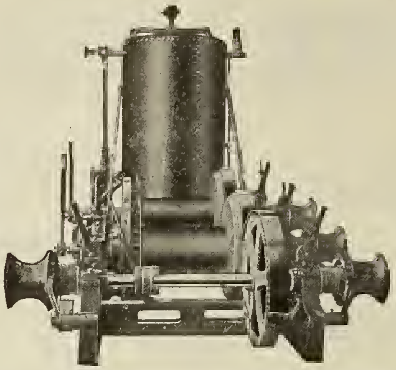

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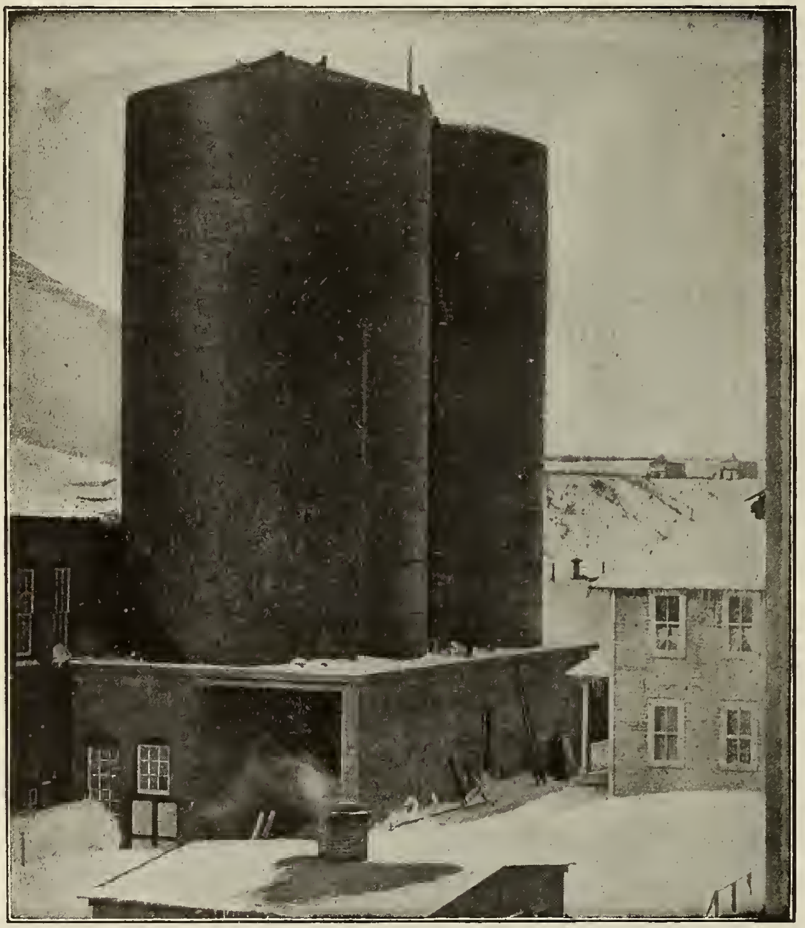

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EQUIP YOUR CELLAR

with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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From time to time in this space the various items will be discussed. At this writing, however, we wish to emphasize the "Quality" which has been the keynote of the "Metallic" success.

Since we commenced manufacturing in 1884 we have continuously maintained a high standard of Quality in **Materials, Workmanship and Service.**

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Towers and Tanks for all purposes.

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Water supply outfits of every description.
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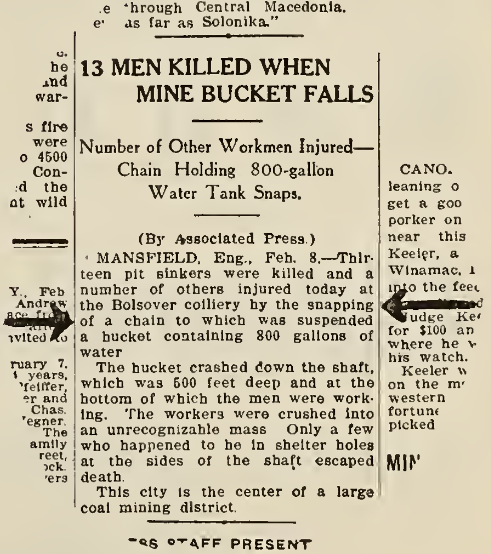

13 MEN KILLED WHEN MINE BUCKET FALLS

Number of Other Workmen Injured—Chain Holding 800-gallon Water Tank Snaps.

(By Associated Press.)

MANSFIELD, Eng., Feb. 8.—Thirteen pit sinkers were killed and a number of others injured today at the Bolsover colliery by the snapping of a chain to which was suspended a bucket containing 800 gallons of water

The bucket crashed down the shaft, which was 500 feet deep and at the bottom of which the men were working. The workers were crushed into an unrecognizable mass Only a few who happened to be in shelter holes at the sides of the shaft escaped death.

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SINCE MARCH 1st
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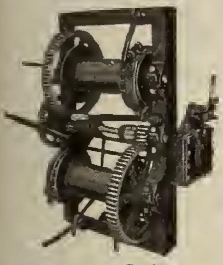

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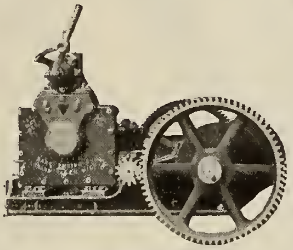
Grand Haven, Mich.



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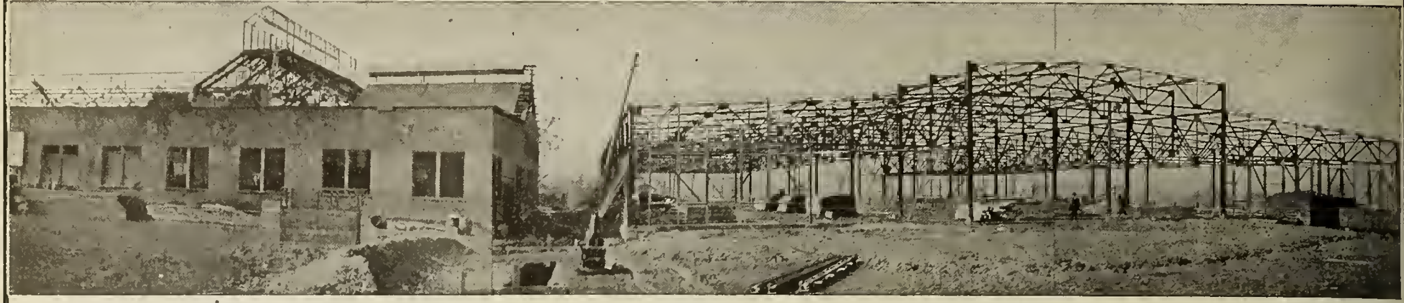

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460 feet x 8 feet 2 in.

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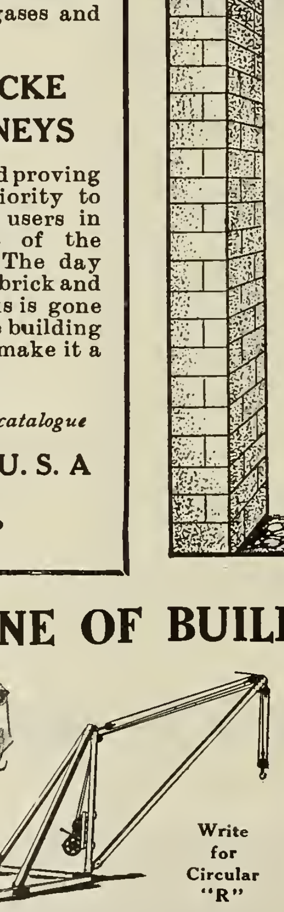

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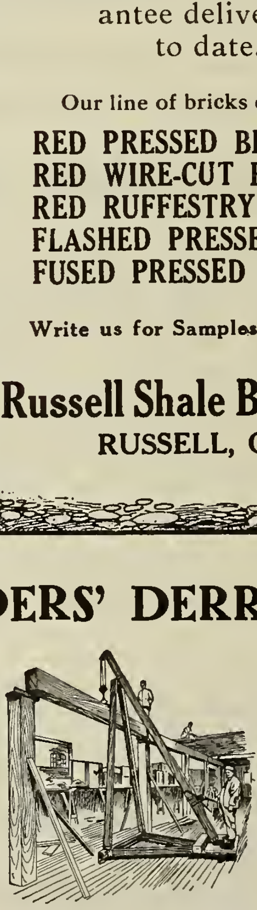

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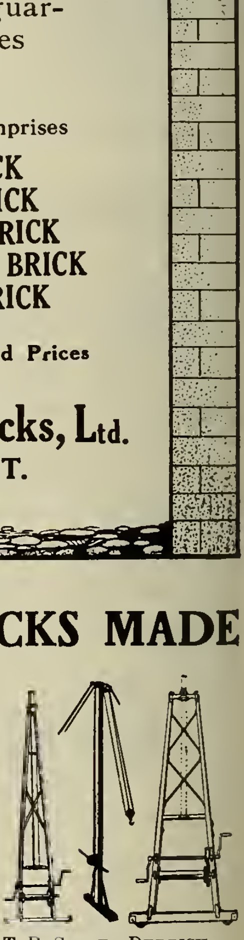

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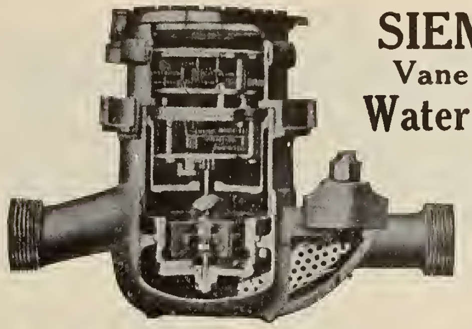

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Dry
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The Main Advantages:

Simple, solid construction, involving only a few easily interchangeable parts. Best workmanship and accurate adjustment. Large sack-like strainer which has five to ten times the clear cross section of the connecting sockets. This can be taken out without removing meter from pipe. All toothed wheels are cut on special machines, not stamped. Only the best celluloid is used for vane wheels. Meters are fitted with regulating device easily adjusted from outside. Graphite is used for bearings of vane wheel shaft, rendering oiling of bearings unnecessary and is not influenced by water containing salts or acids. Frost proof device.

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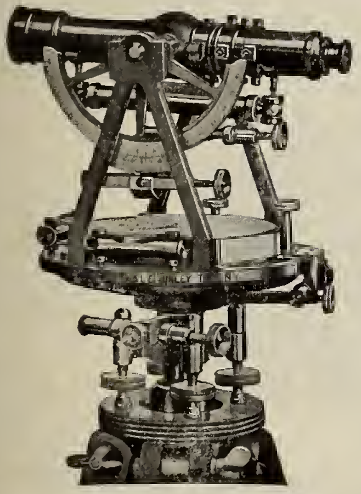

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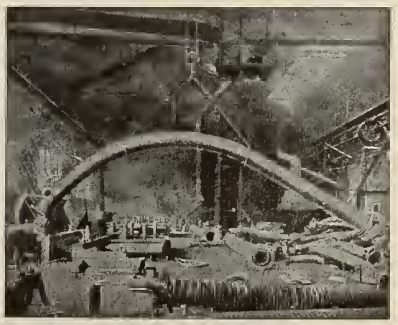

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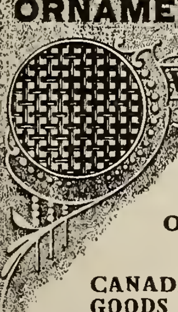

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Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $30; sand-lime brick, $8.60, King Edward Siding; $7.50 at the mill; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 6 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $4.

Steel channels and beams, angles and plates—$2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 64c per gal. of 9 lbs.

Raw linseed oil—in bbls., 61c per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 70c.

MONTREAL PRICES

CEMENT, LIME AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $24, red $24, buff $25, white $47, plain pressed $12 per thousand, all f.o.b. Montreal.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15c basis per pound; British manilla, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 66c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in carload lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 lbs.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

(Continued on page 106)

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10—It is so constituted that it will not be injured by the heat necessarily applied to melt it for paving operation.

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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from p. 104.)

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.85 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Harner Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $8.85 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.75; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 85c per gal. of 9 lbs.

Raw linseed oil—in bbls, 83c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

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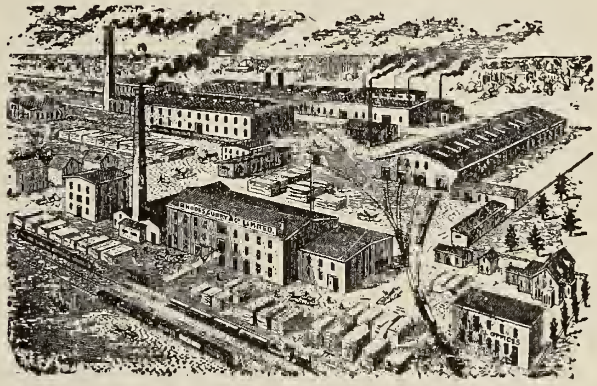

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Specialists in Underground Piping
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Testing of bricks, cement and road material.

Examination of Quarries and Mines.

Design of Crushing and gravel washing plants.

Inspection of rails, pipes, building material and buildings in course of erection.

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Expert Supervision Provided
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Pavements, Roads, Waterproofings, Floors, Sidewalks, Tars, Asphalts, Bitumens, Oils, Paints, Bituminous Specialties.

A new plan for Efficient Road and Paving Inspection

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Dominion Engineering & Inspection Co.

Inspecting and Consulting Engineers

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MONTREAL

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Cement Testing and Reinforced Concrete Inspection.

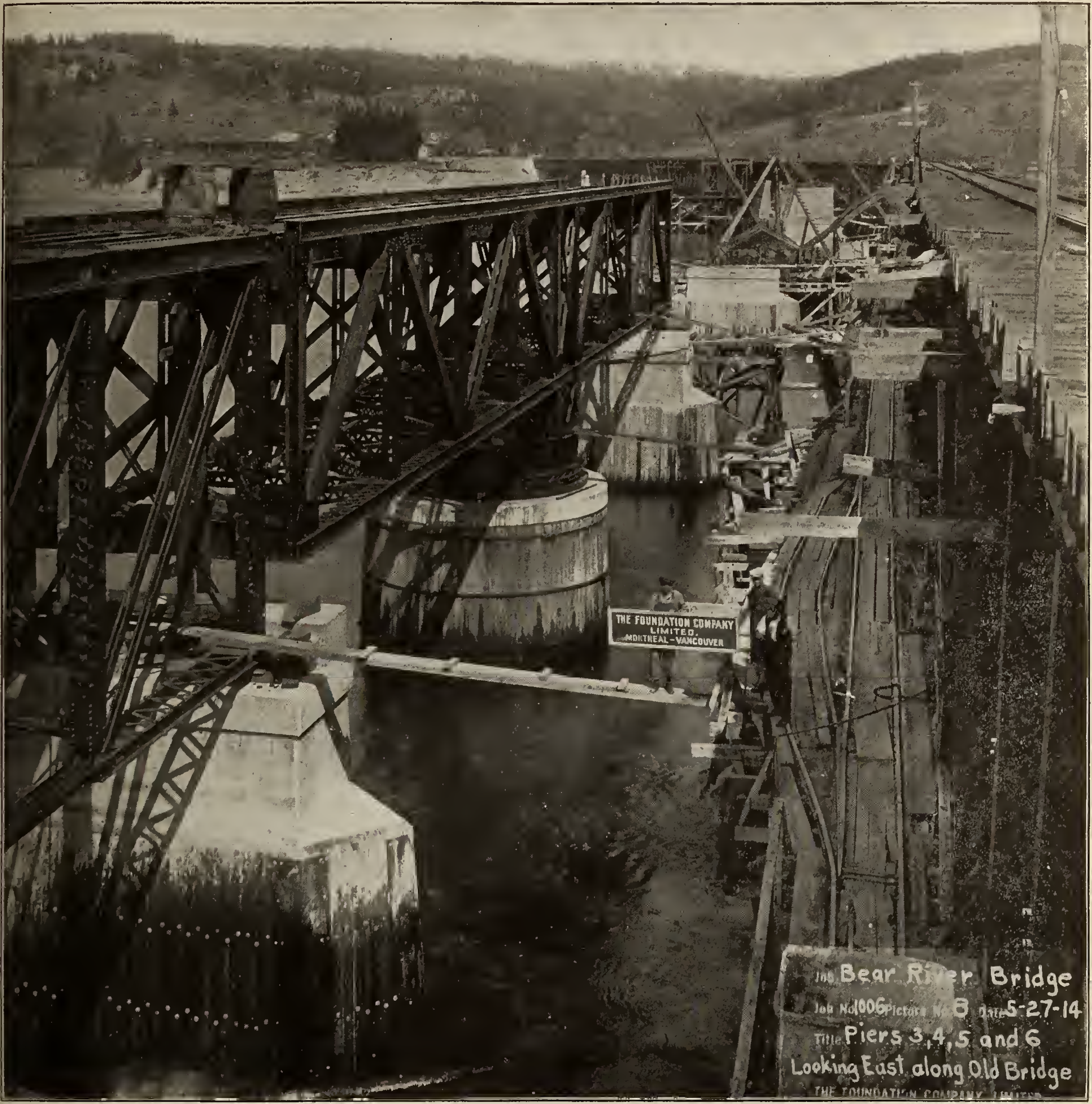
Mill, Shop and Field Inspection of Steel Structures and Bridges.

Tests and Inspection of Iron and Steel Pipe etc.

Expert Examinations & Reports.

Represented at New York, Pittsburgh, and Chicago; Glasgow, London, Liege and Essen.

ONE OF OUR RECENT BRIDGE CONTRACTS


THE FOUNDATION COMPANY
LIMITED.
MONTREAL-VANCOUVER
Bear River Bridge
Job No 1006 Picture No 8 Date 5-27-14
Title Piers 3,4,5 and 6
Looking East along Old Bridge
THE FOUNDATION COMPANY LIMITED

Dominion Atlantic Railway Bridge—Over the Bear River, Near Digby, N. S.

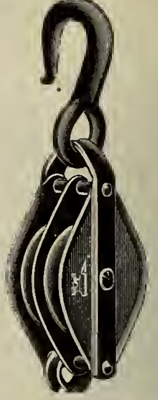
The above piers were built by dredging open caissons through sand, clay and gravel to a firm foundation, the deepest being founded 86 ft. below High Water Level. A 24 ft. tide at this point greatly added to the difficulties of construction which was carried out through the most severe winter weather.

Your inquiries are solicited on any kind of difficult foundation work

THE FOUNDATION COMPANY LIMITED

MONTREAL VANCOUVER

Aikenhead's



Canada's Leading Tool House

Headquarters for Contractors Supplies of All Kinds

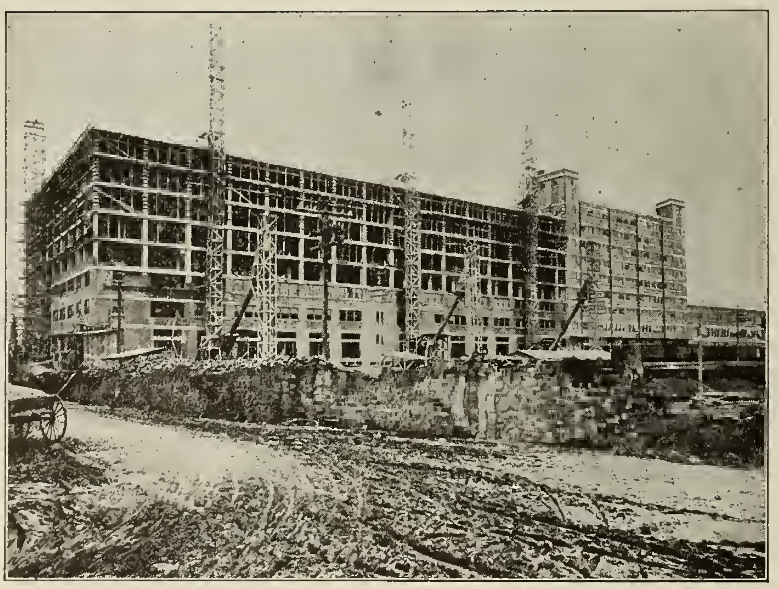
Our line is the best from the standpoint of workmanship, durability and price. A few of our specialties: **Tackle Blocks, Speidel Chain Hoists, Buda Jacks, K & J Scrapers, K & J Wheelbarrows, Joist Hangers, Bell Traps, Sand Shovels, Cement Tools, Jenkins' Valves, Pipe Fittings.**

Aikenhead Hardware Limited

17 Temperance St., Toronto, Can.

WHOLESALE RETAIL

THE TURNER MUSHROOM SYSTEM



View of Sears-Roebuck Company Building, under construction, Dallas, Texas

REINFORCED CONCRETE FLAT SLAB CONSTRUCTION
(Patented)

The recent decision of the Hon. Chas. A. Willard in the U. S. District Court of Minneapolis in the Drum vs. Turner concrete patent case sets at rest pretended claims of Mr. Turner's imitators.

All infringers are being rigidly prosecuted, as Mr. Turner has in his employ at the present time five of the best known and most able firms of patent attorneys in the United States.

OWNERS, PROTECT YOUR OWN INTERESTS by demanding that your flat slab designers furnish an infringement bond of an amount equal to the cost of your building. Demand a bond for a five-year term and make yourselves safe.

THE MUSHROOM SYSTEM is the original reinforced concrete flat slab system and is the only legitimate flat slab on the market today.

For designs, estimates and suggestions embodying the best of our long experience, you have only to consult our Engineers, without any obligation on your part.

Make the Concrete construction in your building secure by utilizing the long experience, right design and efficient service behind the Mushroom System.

C. A. P. TURNER
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Consulting and Contracting Engineer
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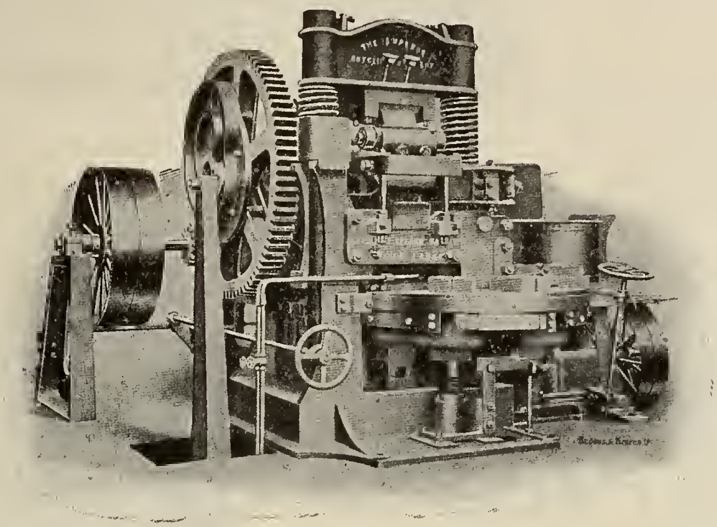
Calgary, Alta.
312 Leeson & Linehan Building

Vancouver, B.C.
424 Vancouver Block

BRICK PLANTS



Lime-Sand

Clay, Slag,

Clinker,

&c., &c.

Installed

Complete

on Best

Lines.

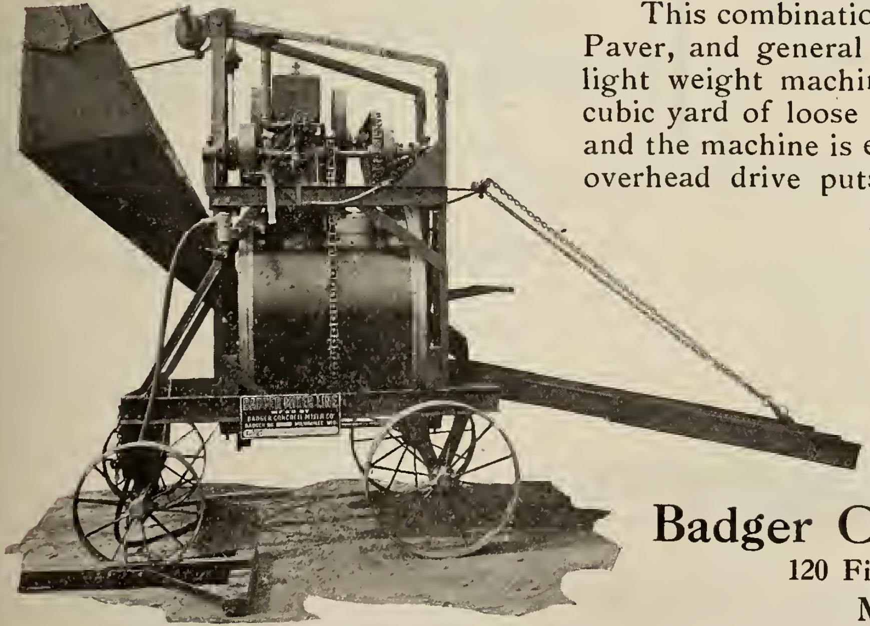
World Wide Experience.

SUTCLIFFE, SPEAKMAN & CO., LTD. LEIGH,

CABLES—" Utilization Leigh" CODES—A B C. 5th Edn. McNeill 1899 Edn.

LANCASHIRE, ENG.

Badger Road Builder Street Paver and Mixer



This combination Badger Road Builder, Street Paver, and general purpose Mixer, is an all-steel, light weight machine, with a capacity of one-half cubic yard of loose material. The wheels are high and the machine is easily moved by two men. The overhead drive puts the engine out of the way, enabling the crew to work on all sides. The Badger is the simplest, strongest and best designed road builder and street paver on the market. This is the only Mixer that will meet all the various requirements of the contractor for efficiency and general utility. No vibration.

Write for our prices—they will interest you.

Badger Concrete Mixer Co.
120 First National Bank Bldg.
Milwaukee, Wis.

JAMES THOMSON, President. J. G. ALLAN, Vice-President. JAMES A. THOMSON, Secretary.

THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.
LIMITED

Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

CAST IRON PIPE

3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

HAMILTON, ONT.

"Hammer Brand"
Hard Wall Plaster

HARD-WALL PLASTER HAMMER BRAND HILLSBOROUGH, N.B.

It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

Albert Manufacturing Co.
Hillsborough, New Brunswick, Canada

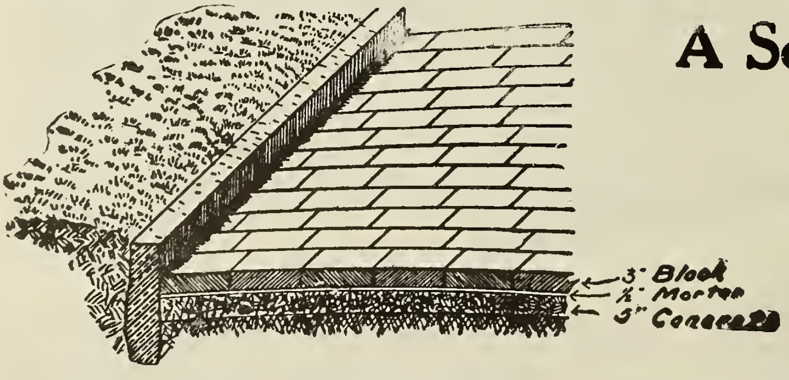
Stair at Provincial Museum, Toronto.

This is a good example of Meadows' stair work. Our plant is complete for the successful manufacture of this particular class of work. Specifications can be followed or we will submit designs.

Careful attention to details and thorough workmanship have made Meadows' stair work popular.

QUOTATIONS FURNISHED.

The GEO. B. MEADOWS
Toronto Wire, Iron and Brass Works Co., Limited
Meadows Block, Wellington St. W.
TORONTO, ONT.



A Scientific Pavement
must be

Durable and Non-Abrasive.
Non-Absorbent and nearly Noiseless.
Unaffected by extremes of Temperature
Sightly and Sanitary.
Easily Repaired and easily Cleaned.

These requirements are met by
Asphalt Block Pavements
Send for Descriptive Literature.

The Ontario Asphalt Block Company, Limited - Windsor, Ont.

Raising the Wreck of U.S. Battleship Maine

Bulletin 102 Edition 2
Just off the Press

The perfect behavior of

Lackawanna Steel Sheet Piling

in the Maine work through the driving, filling of cofferdam pockets, unwatering and pulling of piling offer strong evidence of the success which is achievable in cofferdam and foundation work by proper use of this sheet piling. A copy of this bulletin will be sent to engineers and contractors on application.

H. A. Drury Co.
Montreal and Toronto Limited

You Eliminate Needless Risk
when you install Standard Rubber Insulated Wire in that building of yours. Its guarantee of safety consists of many years of unusually successful and dependable service and in the fact that it is specified and used by architects, engineers and contractors of many buildings of international importance, one of which is shown below.

STANDARD Rubber Insulated Wire
stands for maximum economy and durability. It exceeds N. E. C. requirements to a degree that entitles it to be considered as a separate and higher standard of excellence.

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Winnipeg, Man.
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Ross & McDonald,
Montreal, Que.
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Get prices of STANDARD *wire from our nearest office before you buy.*

Standard Underground Cable Co. of Canada, Limited
Hamilton, Ont.

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TENDERS FOR WORK

We would be pleased to submit prices on timbers of any description for building

Tugs Dredges Scows
Wharves Coal Shoots or Piling

It would be entirely to your advantage to have competitive prices on your requirements, and to have our prices even if only as a matter of record.

OUR MILLS RUN ALL WINTER.

JAMES SHEPPARD & SON
SOREL, QUE.

"BUFFALO" FANS
KEEP THE AIR MOVING

A "BUFFALO" DISK FAN

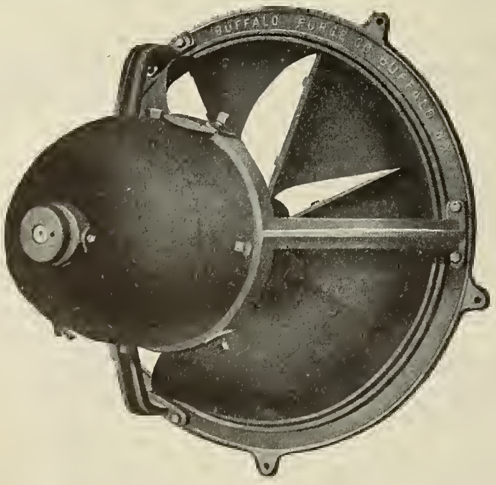
will remove that foul, overheated air and replace it with fresh invigorating air direct from the outside.

Why swelter next summer. Play safe. Equip with a "Buffalo" Disk Fan.

We offer a simple and inexpensive means of moving large volumes of air at low pressures or against small resistance. No other device is so effective or economical for cooling rooms in which heat is generated such as laundries, engine and boiler rooms, veneer rooms, etc.

Bulletin No. 262-12 illustrates and describes these fans in detail. Let us send you a copy.

CANADIAN BUFFALO FORGE CO.
BERLIN Limited
ST. JOHN MONTREAL TORONTO WINNIPEG VANCOUVER



"BUFFALO" ELECTRIC PROPELLER FAN

Warehouse Space To Let

5 Floors of This New Building, For Office and Warehouse Use.

Adelaide St. W., Toronto

This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

- Centrally situated
- Light on four sides
- Passenger and freight elevator
- Vaults
- Low insurance
- One block from four car lines
- Floor area, 6,300 sq. feet, each floor.
- Building ready for occupancy July 25th.

For further particulars ask

R. A. Donald
Union Bank Building - Toronto

Save Money On Your Lime

This can be done by using lime that will make the maximum quantity of mortar per 100 lbs. of lime.
By using lime that does not require much time for tempering.
By using lime that is always of the same unvarying high quality. In short, use

Renfrew Lime

and you will save money and have a permanently clean-cut masonry job.

Try "RENFREW" on your next job.

Jamieson Lime Company

Renfrew, Ontario

BRICK — LIME — DRAIN TILE

Across Canada with the

Imperial Wire & Cable Company, Limited

Seventh of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire and Cable Co's. Limited, wires.

This picture shows the

World Building, Vancouver

This building was wired with
"Adanac" Rubber Insulated Wire

Architect: W. T. Whiteway, Vancouver.
Engineer: W. E. Hughes, Vancouver.
Electrical Contractor: J. G. Sutton, San Francisco, Cal.

Address enquiries to our nearest office

Northern Electric Company
LIMITED

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Calgary
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Victoria

Successor to IMPERIAL WIRE & CABLE CO., Limited

Correspondence previously addressed to Imperial Wire & Cable Co., Limited, at 611 C.P.R. Building, Toronto, and 902 Electric Railway Chambers, Winnipeg, should now be sent to Northern Electric Company, Limited, Simcoe St., Toronto, and 599 Henry Ave., Winnipeg.

WIRE ROPE

WIRE ROPE

MANUFACTURED BY
THE DOMINION WIRE ROPE CO., LTD., MONTREAL

"Industrial Works"
Locomotive-Coaling and Wrecking
CRANES
In capacities from
5 to 150 tons
For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.

BUCKETS
For Every Purpose

We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc. in all sizes.
We will gladly furnish full details upon request
We supply CONTRACTORS' EQUIPMENT of all descriptions

F. H. HOPKINS & CO., HEAD OFFICE MONTREAL
Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

Vol. 28 Toronto, August 12, 1914 No. 32

ESTABLISHED 1886

Contract Record and Engineering Review

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Engines and Air Compressors

Over 150 Sets Installed in Canada

Laurie & Lamb
Sole Agents for Canada for

R. HORNSBY & SONS
Gas and Oil Engines

PATERSON ENGINEERING CO.
Municipal Filtration Plants

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W. SMITH & SONS
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"FRAM" Electric Wagons

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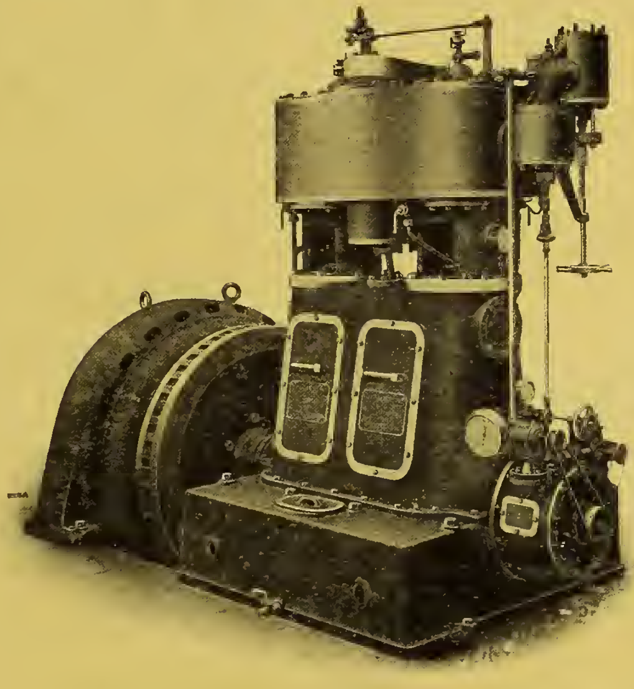
Refuse Destructors



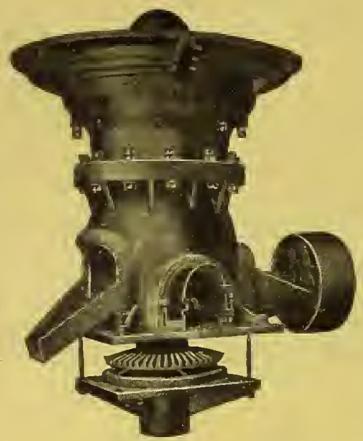
570 B.H.P. Belliss engine at 375 r.p.m.

LAURIE & LAMB

Engineers

212 Board of Trade Bldg. :-: :-: MONTREAL

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6



Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

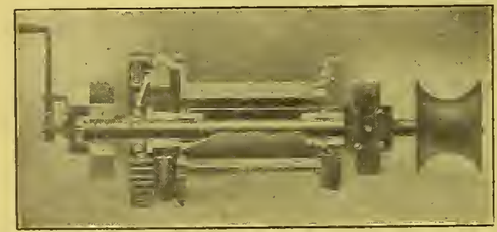
We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson

If You Had to Run It Yourself Which Engine Would You Choose?



Suppose you were engineer of a hoisting engine, operating a clamshell bucket or running a derrick that required fast, continuous work, which would you prefer—an engine with an easy operating friction; easy to throw in, easy to hold in, or one with a friction that required violent effort to throw it in and equally violent effort to hold it there? That's the difference between

"AMERICAN" EXPANSIVE TYPE FRICTIONS

and the cone type universally sold with other engines—a type in which it is necessary to push the whole drum across the shaft and hold it there by main strength. The strength and weight of the operator and the push of the thrust screw have to do the whole job.

"AMERICAN" Friction supplements the push of the thrust screw with the toggle action of the friction; this produces a thrust several times greater than the unassisted push of the thrust screw.

An untired operator is bound to get better results than one fagged out by needless tussling with a cumbersome machine.

The cool running "AMERICAN" friction; quick, positive, easy to operate, will save you money. Make us prove it.

—MADE BY—

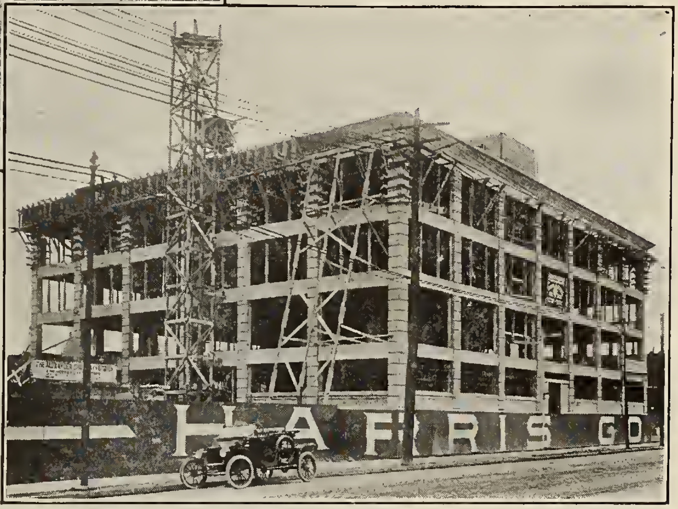
AMERICAN HOIST & DERRICK CO.

ST. PAUL, MINN.

SOLD BY—

General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto, Canada.
Gorman, Clancey & Grindley, Edmonton, Alta., and Nelson, B.C.
Stuart Machinery Co., Limited, Winnipeg, Man.
Vancouver Machinery Depot, Limited, Vancouver, B.C.

Factory buildings of the Massey-Harris Co., Limited, Toronto, Ont.—Another striking example of how concrete construction is valued by large manufacturers.



Economical Factory Buildings

Concrete stands for economy and is the solution of low maintenance cost in factory construction. It practically eliminates the necessity of repairs. Its permanence makes the use of concrete a profitable investment.

Concrete Buildings

do not depreciate in value because of deterioration, and maintenance cost is reduced to the minimum.

They are proof against fire, wind and water. They permit of maximum light, are sanitary and increase the efficiency of employees.

The best evidence of the value of concrete for factory construction is contained in the above photographs of the Massey-Harris Company's buildings—their first concrete building proved so eminently satisfactory that when another building became necessary **it, too,** was built of concrete.

Let us send our handsomely illustrated 224 page book, "Factories and Warehouses of Concrete." It contains complete information and photographs of factories and warehouses for every purpose.

TELL YOUR STENOGRAPHER TO SEND FOR IT TO-DAY.

Information Department

Canada Cement Company
Limited
883 Herald Building, Montreal

Union Pile Hammers

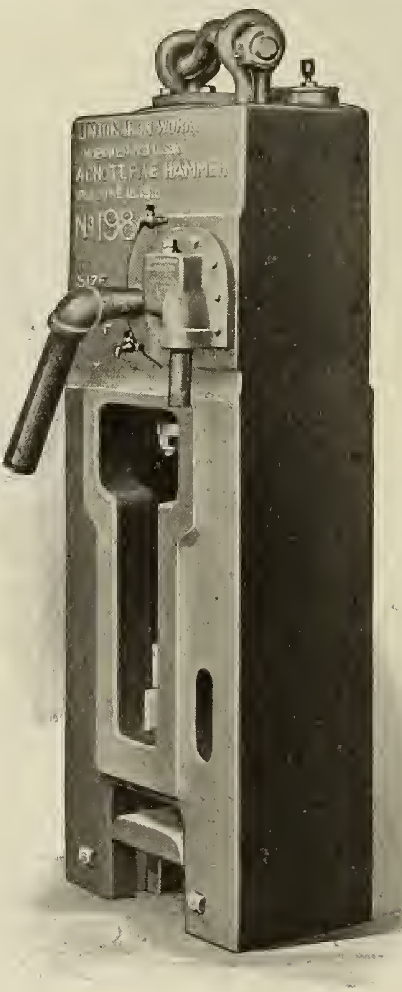
Strike such rapid blows that the pile is continually sinking until the hammer is removed, overcoming the inertia and initial friction at every drop caused by a drop hammer.

The UNION Pile Driving Hammer

Double acting, rapid stroke—will solve your driving problems.

Economical and easy to run.

One of the ten sizes (12 tons Mammoth to 135 lbs. Midget) will fit your job and save you money.



Will drive the big round wooden piles in one-tenth of the time.

Offers the contractor the proven advantages of rapidity; easier driving, deeper penetration, greatest resistance to damage of hammer or materials, saving in head room, adaptability to lightest or heaviest work.

Put a "UNION" on your next job.

Catalogue on Request.

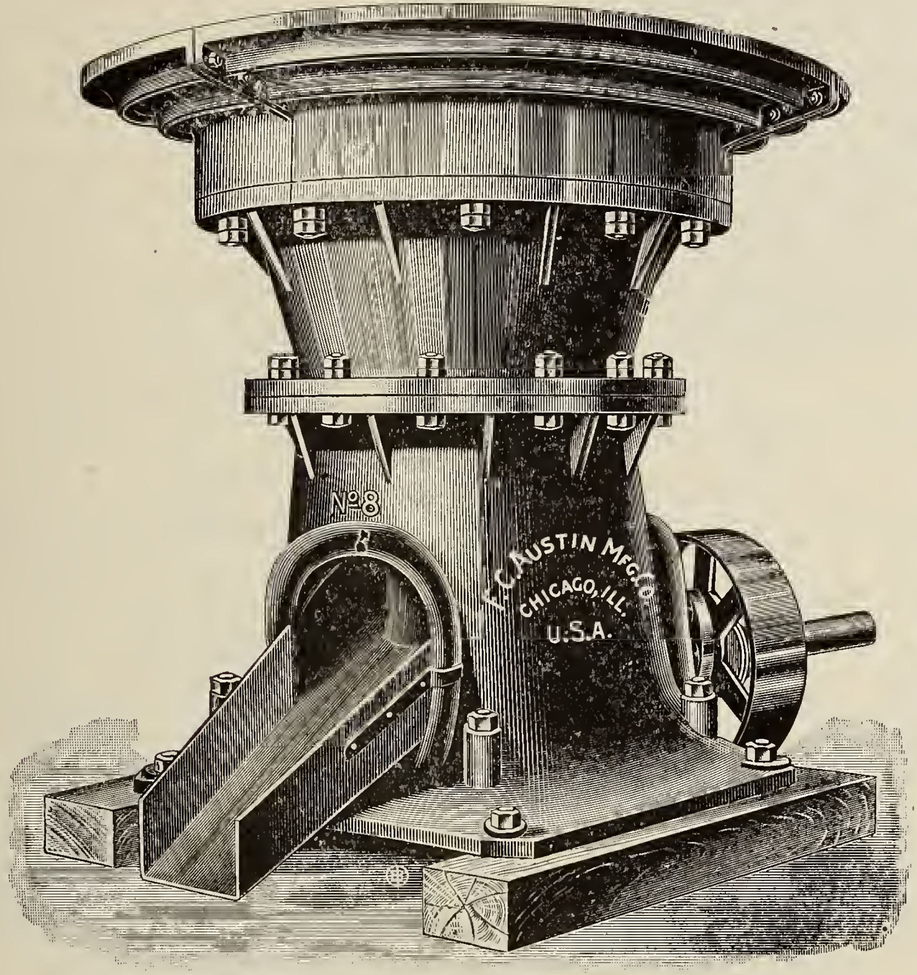
Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

Austin Gyratory Crushers

Made in nine sizes with capacities from 50 to 5000 tons per day.

STRONG
DURABLE
EFFICIENT


No. 8
F. C. AUSTIN MFG. CO.
CHICAGO, ILL.
U.S.A.

Its many superior qualities and mechanical advantages have won the highest reputation among engineers and quarrymen.

Have Automatic Oiling Systems. Rigid Eccentric Bearings; Same Sized Rock Received After Adjustment of Head and Concaves for Wear; Convenient Adjustments.

Particulars Furnished on Application.

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
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(Continued on page 12)

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Durability is a feature of Bessemer Block pavements because the most carefully selected shale is made into a tough durable block through a highly efficient patented process. The rough sides of the block afford a binding surface for the cement grouting and insures a uniform, dustless surface.

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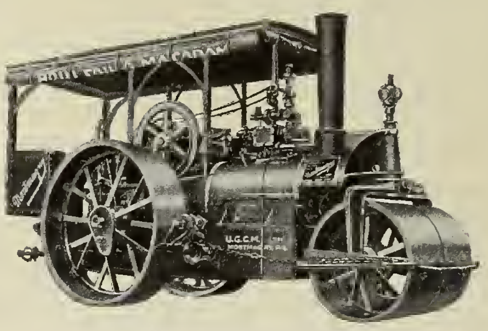
"Montmagny" Modern Road Builders



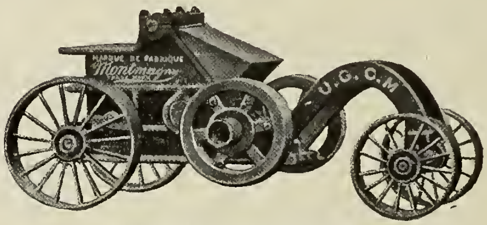
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"



"Montmagny" Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

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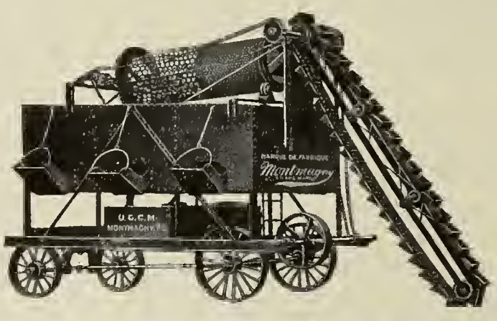


"Montmagny" Portable Steel Bin.

Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

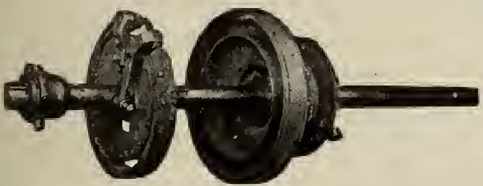
Showing Features Which Insure

"Most Mixing, Least Fixing"

All-Steel Rail Tracks
The M-C is the only mixer fitted with real railroad tracks around the drum. These rail tracks are of standard rolled steel sections. They run true and wear four or five times as long as cast-iron rings.

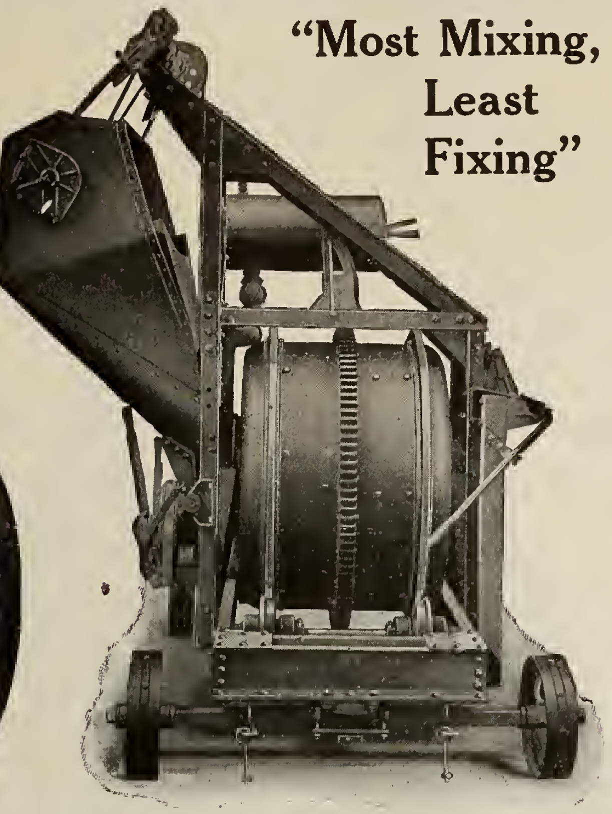
REAL RAIL ROAD RAILS
THE GEAR IS SEMI-STEEL-MADE IN SEGMENTS BEST KIND OF INSURANCE AGAINST DELAYS
THE RAIL TRACK MIXER MANUFACTURED BY MARSH-CAPRON MFG. CO.

Cast Semi-Steel Drum
Made entirely of a high-grade semi-steel of great strength and toughness which offers maximum resistance to the severe scouring action of the sand and stone. A drum like this, more than half an inch thick, wears three or four times as long as a steel plate drum ⅛-inch thick.



M-C Friction Clutch
The M-C is the only mixer using the steel-band-lined-with-wood-blocks type of friction clutch which is the only type of clutch which will stand the severity of side loader service.

Discharge Half of Drum
Extra large and heavy steel buckets. Reverse the discharge spout and any batch is completely discharged in from 15 to 18 seconds. No square corners or dead spaces where concrete will set.



M-C Rail-Track Mixers

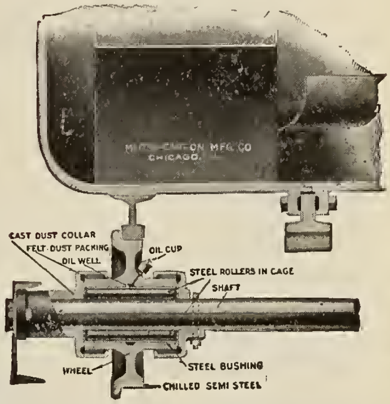
are built in the strongest manner possible for every kind of concrete construction work.

The standard line is built in many designs, in many sizes.

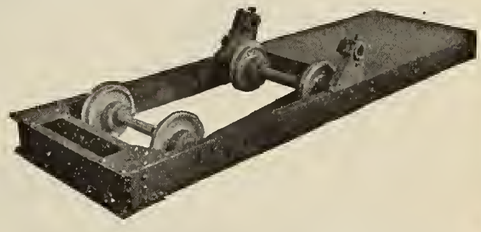
The paving mixers are the marvel of all who have seen them; being simpler, yet having every advantage of other pavers—and many advantages not found on other paving machines.

A beautifully illustrated catalog has just been prepared telling all about the entire line. A copy is yours for the asking.

Segmental Drum Gear
The M-C is the only mixer in which the main drum gear is built in segments bolted in place, to facilitate making repairs. If you have ever had trouble with a solid gear ring you will appreciate the advantages of this feature.



Detail of Roller-Bearing Wheels
on which the M-C Rail Tracks roll. These wheels are of extra large diameter, are made of chilled semi-steel and are of the same type as used on cars in extremely severe mining service. They have heavy flange on one side, insuring straight, true turning of the drum regardless of its load.



Heavy Steel Channel Frame
held square by steel plates. No twisting or binding of this frame is possible, so the true alignment of the machinery is always maintained.

Charging Half of Drum
Highly developed, practical, proven arrangement of heavy steel mixing blades insures thorough mixing.

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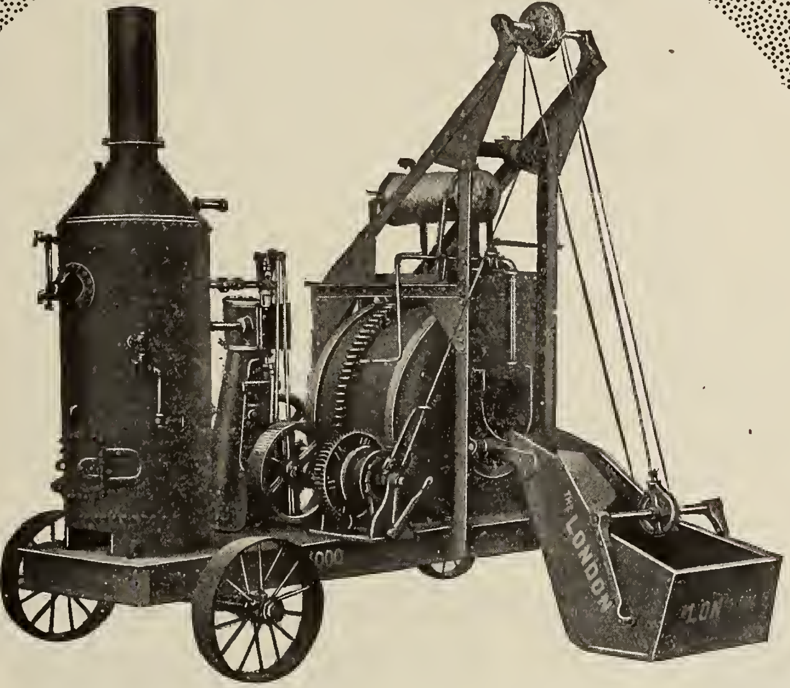
The LONDON Concrete Mixer



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"A triumph of scientific principles." Built entirely of steel in five sizes. Capacity 60 batches per hour. Adaptable to all classes of concrete work. Fitted with any kind of power.

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The London Concrete Machinery Co., Ltd.

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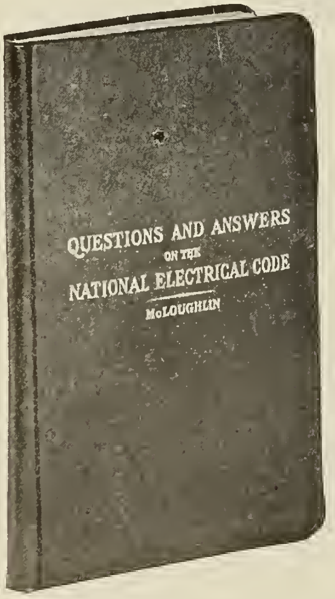

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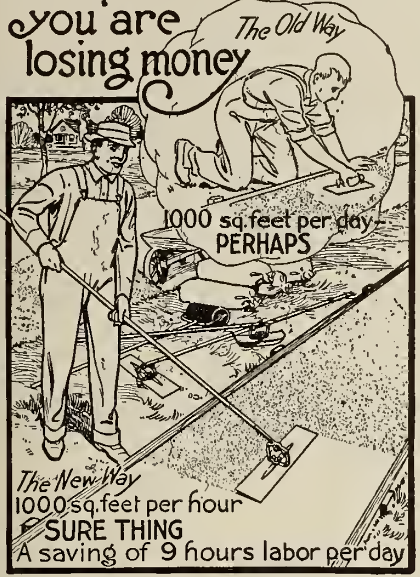

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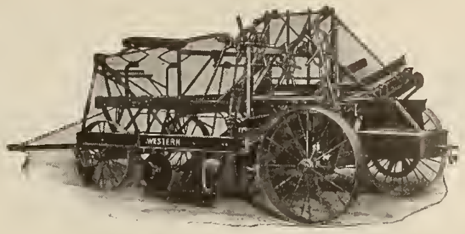

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Numbers of these graders are in use on railroad work and in building canals, and have been adopted by many contractors and highway officials engaged in earth handling.

If you have an excavating proposition in view, we invite you to write for our illustrated catalogue.

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that will cement
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(Continued on page 18)

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Made in different styles and sizes to suit various requirements. Easily detachable and most economical. Costs only a few cents per hour.

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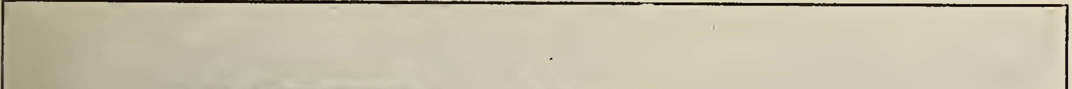

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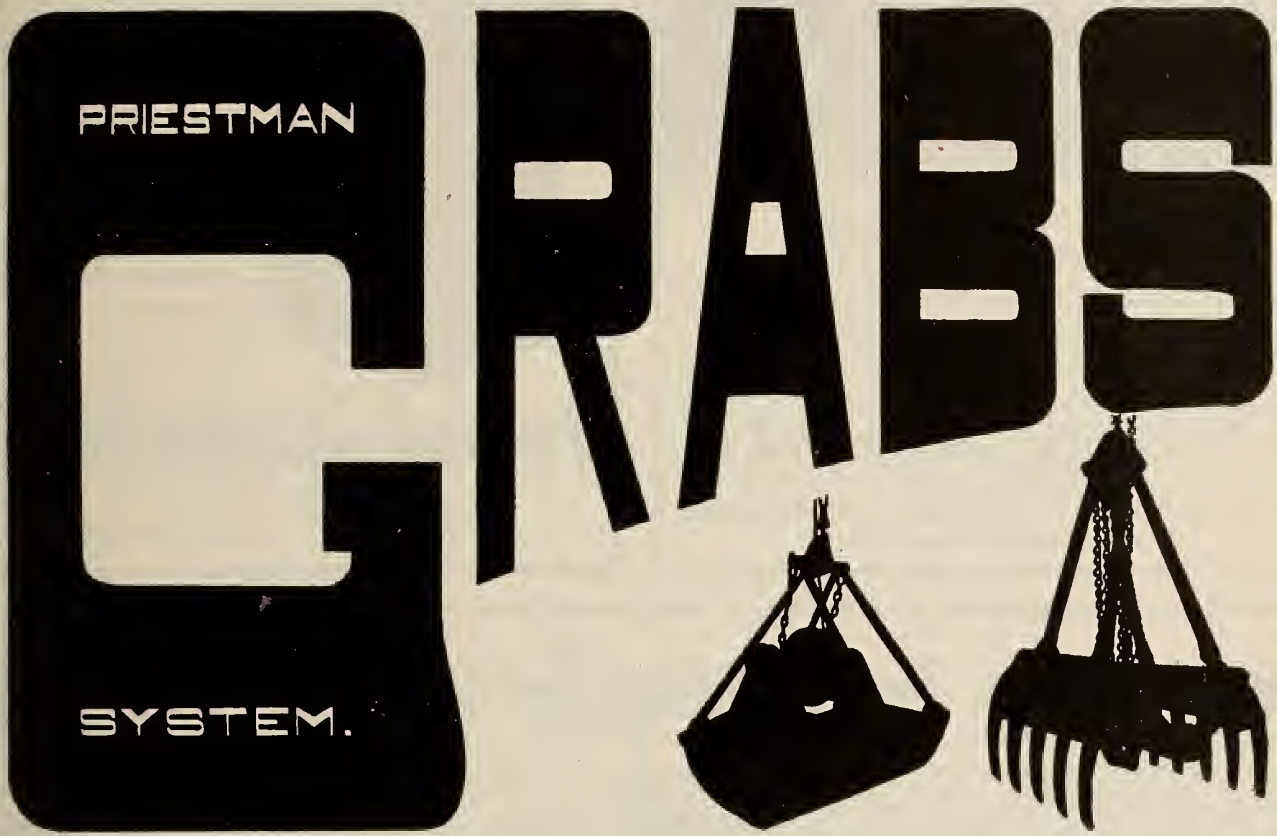

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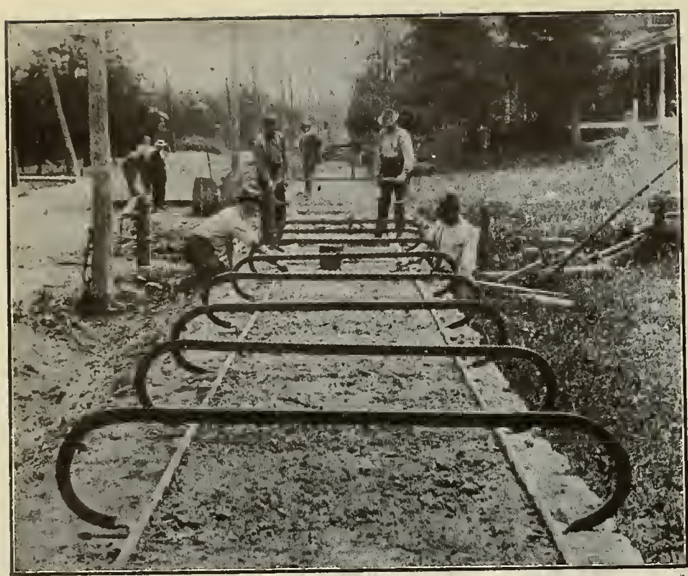

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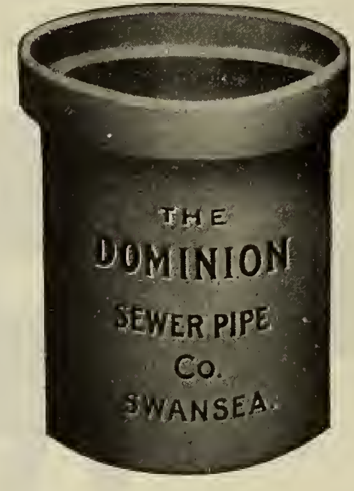

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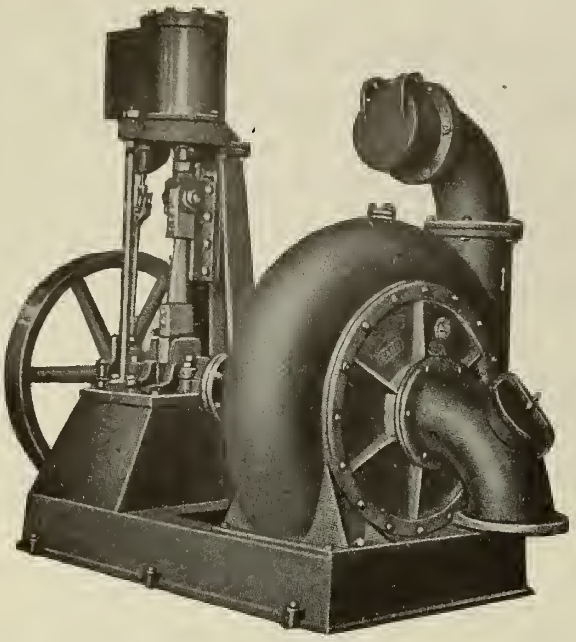

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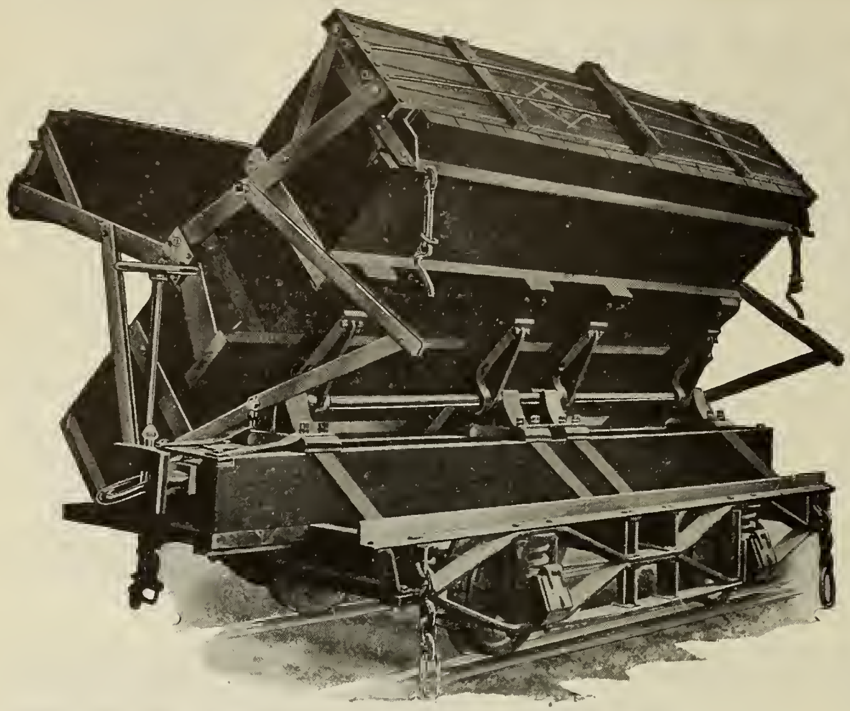
Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application

Dominion Concrete Company Ltd.
Kemptville, Ontario



Cut showing 4 and 6 yard Double Diamond Steel Frame Car in dumped position. Full 45 degrees. Door opens away from load.

Last week we began this series showing why our cars deserve your attention and enquiry. Look it up. Keep posted. WRITE NOW.

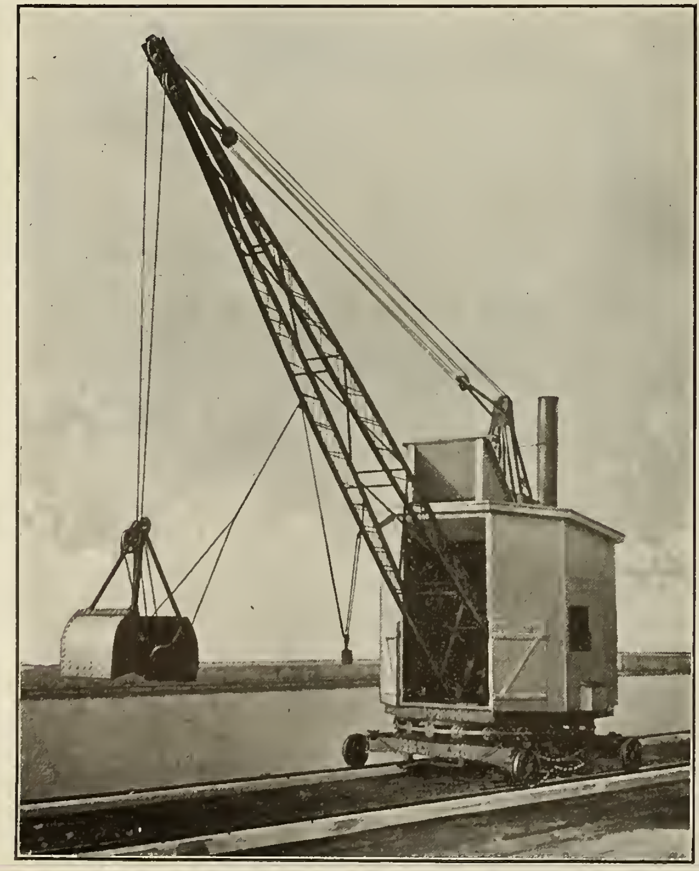
GLENGARRY

You Want a Steel Frame Car to Have Long Life

This new steel frame car will not disappoint. It is built for hard use and lots of it. STUDY THE CONSTRUCTION. Note the under frame support of box. This box cannot sag down. See the bracing of box ends and doors! The drawbars are bolted clear through to "I" beam girts. The diamond frame is the stiffest possible. Note angle on top instead of flat iron bar. The bracing and trussing of these cars is excellent. Arch braces are trussed across drawbars distributing load on trucks in proper form. You could not build a better car!

Watch next week's issue!

The Schell Foundry and Machine Company, Limited
ALEXANDRIA - - - - ONTARIO



For Economical Loose Material Unloading

use a

BEATTY

Travelling and Revolving Derrick

Fitted with a
"FAIVRETTE" TYPE "C"
Clamshell

Our 1914 catalogue illustrates and describes BEATTY HOISTS. Excavating and Handling Equipment for use on land and water.

M. BEATTY & SONS
Limited
Welland - Canada
Established 1862

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H. E. Plant, 1790 St. James Street, Montreal
R. Hamilton & Company, Vancouver, B. C.
H. W. Petrie, Limited, Toronto
E. Leonard & Sons, St. John, N. B.
A. R. Williams Machinery Company, Winnipeg, Man.

KAHN SYSTEM
OF REINFORCED CONCRETE

Steel Sash
Hyrib
Rib Bars
Rib Metal

KAHN SYSTEM
Reinforced Concrete

Concrete Finishes
Water-proofing Pastes

STEEL FLORETYLE
FOR LONG SPAN CONSTRUCTION

Trussed Concrete Steel Co.
of Canada Limited
Head Offices and Works: Walkerville, Ont.
Branches Everywhere

Can Offer
For Immediate Acceptance
300 80,000 lbs. Capacity, Flat Bottom
Gondola Cars Thoroughly Overhauled

Length over end sills, 35 ft.
Width over all, 10 ft. 2¾ in.
Height of sides, 4 ft. 6 in.
Spring plank, Steel channel.
Size of Journals, 5 x 9 in.
Type of Body Bolster, Pressed Steel.
Type of Truck Bolster, Pressed Steel.
Brake Beams, Steel, inside hung.

Largest rebuilders of railroad and contractors equipment in America.

Write for specifications and quotations on anything you need.

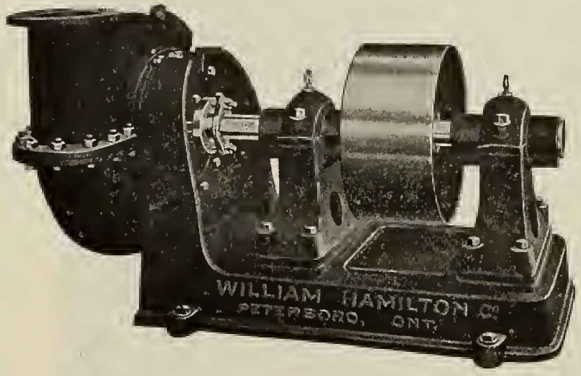
Central Locomotive & Car Works
410 Fisher Bldg. Dept. S.
Chicago, Ill.

$45. GARROW
Contractors Acetylene Flare Light

The great feature of this new light is strength and simplicity. The light is constructed of steel assembled by the Oxyacetylene Welding Process and consists of three parts. It is made to stand the roughest handling by unskilled labor without injury. A distinct advantage of the Garrow Light is its use in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame.

$45.00 F. O. B. Sudbury

The
Sudbury Construction & Machinery Co., Ltd.
Sudbury, Ont.



Contractors' Pumps

These pumps have been specially designed for contractors' use. They are made for belt, direct engine or motor drive.

They have special features not found in any other pumps, notably the horizontally split shell and the wide spacing between pulley and bearings.

They are built in all sizes from 2-in. to 14-in. discharge.

Ask for pump bulletin.

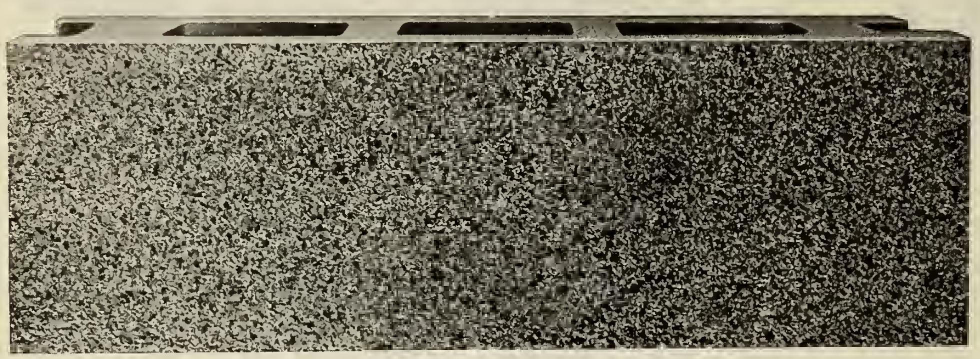
William Hamilton Company
Peterborough, Ontario

Zagelmeyer System

OF CASTING

Hollow Cement Building Blocks

With Granite Faces



They cost less

They sell for more

You sell more of them

8 x 8 x 24 inch Granite Smooth Face Block

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold or moisture.

8 x 8 x 24 inch Granite Rock Face Block

Send us fifty cents and we will send, freight prepaid, to any point in Ontario, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

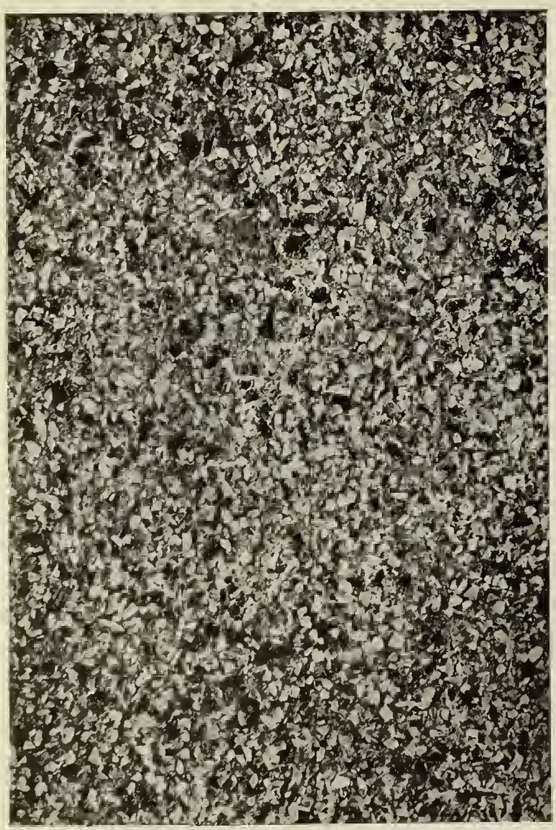
MR. BLOCK MAKER:—

What show will you have if your competitor secures the exclusive right for this system in your city?

MR. CONTRACTOR:—

Get into a business that is protected. Then you will make money.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.



Enlarged View of Granite Smooth Facing

Canadian Zagelmeyer Co.

Limited

298 Howard Ave., Windsor, Ontario

Hull Iron & Steel Foundries, Limited

HULL, - QUEBEC

Manufacturers of

"Adamantine," Chrome and Manganese Steel Castings

(Annealed and Unannealed)

TRADE MARK

Machine - Moulded Gears up to 16 feet. Grey Iron, Semi-Steel, Brass Bronze and Aluminum Castings.

Cement Mill Machinery

Our Specialty

- Tube Mill Feeders
- Griffin Mill Roll Heads
- Ball Mill Plates for Krupp Mills
- Kominuter Plates for Smidths Mills
- Steel Balls for Kominuters
- McCaslin Conveyer Wheels with "Coplan" Self-Lubricating Bushings
- Lining Plates for Bonnot Tube Mills
- Parts for Bonnot Pulverizers
- Screw Conveyer Bearings
- Eccentric Hubs, Crusher Heads and Concave Strips for Gates Crushers
- T. M. Revolving Feeders (new style) for Gates Tube Mills

Patterns for all these lines kept on hand.

We solicit your patronage and prompt attention will be given to tenders on above work.

Montreal Office, New Birks Bldg. Phone up-town 4069

LIQUID KONKERIT

A Decorative and Damp-proof Coating for
Brick, Stone, Cement or Concrete Walls.

Being Specified by Leading Architects

Write for new booklet and color card.

"R. I. W." DAMP RESISTING PAINT CO.

Office: 202 Mail Building, Toronto (TOCH BROS. Est. 1848.) Factory: Oakville, Ont.

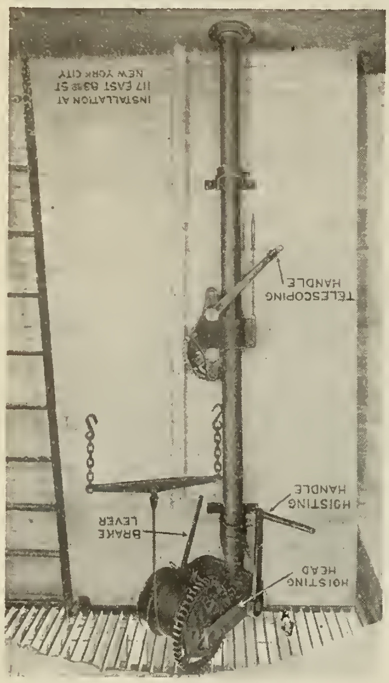
DISTRIBUTORS—Black Building Supply Co., Limited, Toronto Western Paint Co., Winnipeg
Dartnell, Limited, Montreal Canadian Equipment & Supply Co., Limited, Calgary and Edmonton

Write nearest distributor for full information

G & G TELESCOPIC HOIST (PATENTED)

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.



Compact—easy to erect. Takes up no room in basement.

1.—It is telescopic—no part showing above sidewalk when not in use.
2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.
3.—Simple in construction and absolutely rigid when erected.
4.—It is made of strongest and most durable material.
5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.
6.—A powerful ratchet device is provided with both handles above mentioned.
7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.

Hoisting head revolves. Can is deposited on Sidewalk without lifting.

Gillis & Geoghegan

544 West Broadway
New York

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Agents for Ontario
Toronto

B. & S. H. Thompson & Co., Ltd.
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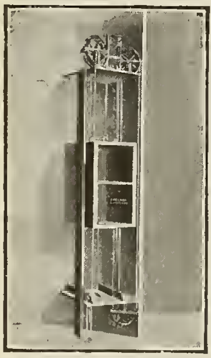
Agents for Manitoba, Saskatchewan, Alberta
Winnipeg

Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

"CHELSEA" Dumbwaiters



NO. 2. TWO-TO-ONE TRACTION DUMB-WAITER
50 to 100 lbs. capacity

NO. 1. ONE-TO-ONE TRACTION DUMB-WAITER
1 to 50 lbs. capacity

The outstanding features of Chelsea dumbwaiters are high speed and quick service, practically noiseless, free from friction and wear. An automatic brake always locks load at once and a pull on the hand rope disengages lock.

Write to our Canadian agents for catalogue and prices.

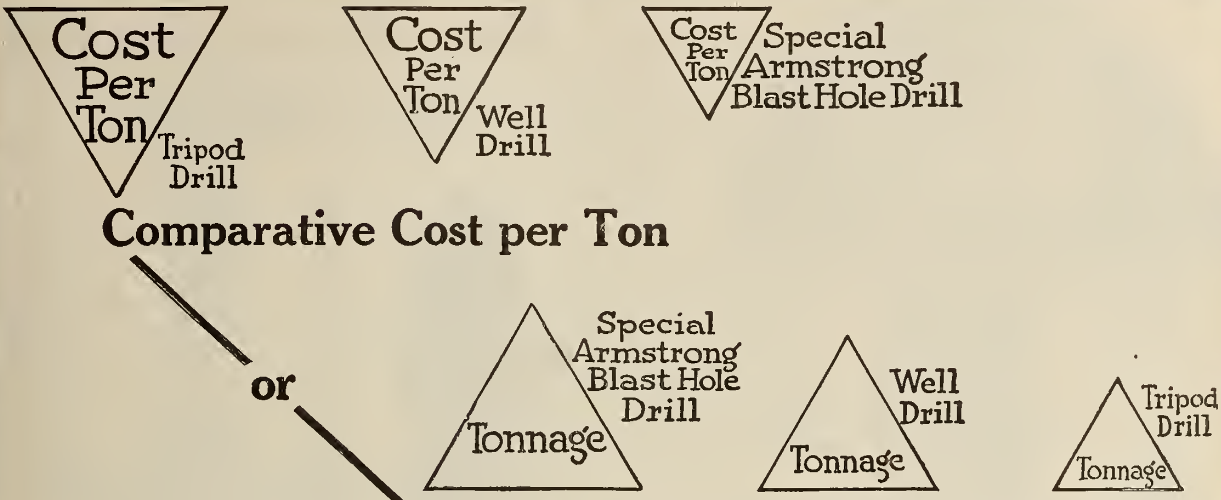
Chelsea Elevator Co.

New York City

Canadian Agents
Hardware Co. of Toronto, Limited, 46 Adelaide St. W.

NO. 5. AUTOMATIC BRAKE DUMB-WAITER
75 to 200 lbs. capacity

NO. 6. PATENT FRAME DUMB-WAITER
100 to 500 lbs. capacity


Cost Per Ton Tripod Drill
Cost Per Ton Well Drill
Cost Per Ton Special Armstrong Blast Hole Drill
or
Tonnage Special Armstrong Blast Hole Drill
Tonnage Well Drill
Tonnage Tripod Drill

Comparative Cost per Ton

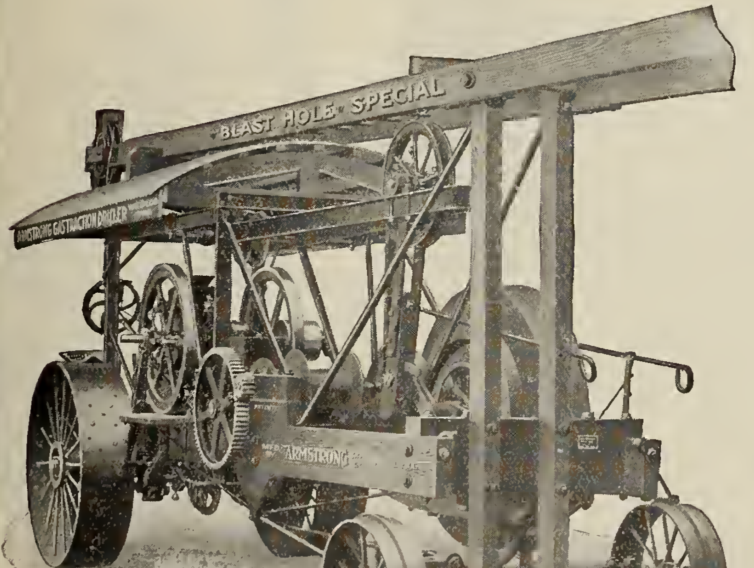
Increased Tonnage at the Same Cost

ISN'T it more economical to shoot out the *whole face* in one blast rather than take the rock out in benches? It saves a big share of the cost of powder per ton of rock—it eliminates several settings of track and movement of machines—it minimizes the delay of your crew and shovel—it reduces the possibility of accidents.

And isn't it more economical to drill the necessary good sized deep holes for face shooting with a drill that releases a quick, heavy, smashing blow at every contact, and at a speed that cannot be obtained by the use of well drills?

It is the efficiency and design of the Special Armstrong Blast Hole Drill that make possible the wide difference in results in comparison with any other method.

Armstrong
BLAST HOLE DRILLS
BUILT FOR SERVICE SINCE 1867



Proof from an Armstrong Owner

Armstrong Mfg. Co., Waterloo, Iowa.

We are glad to advise that the drilling machine recently purchased from your company, according to proposal submitted under date of February 20th, wherein you guarantee to drill a minimum footage of 65 feet per day, has fulfilled the requirements, and we are glad to fulfill our part of the proposal.

A. & C. STONE COMPANY
By JOHN MURNANE.

Mr. Murnane made a test with the Armstrong Blast Hole Drill with the following result:

Drilling time—10 days.
Footage drilled—722½ feet.
Number of moves—40 (11 hr. 59 min. moving time).
Delays caused by rain and moving, changing bit, batteries, etc.—19 hr. 22 min.
Delay caused by rain alone—6 hr. 7 min.
Delay in two 200 yd. moves turning machine around—4 hr. 40 min.
Footage drilled per day—72¼ ft.
Footage drilled per hour—9.1 ft. net (7.2 counting delays).

We guarantee the Armstrong Special Blast Hole Drill to drill MORE hole at less cost in a given time than any cable drill on the market, and we will write this in every sale contract we make.

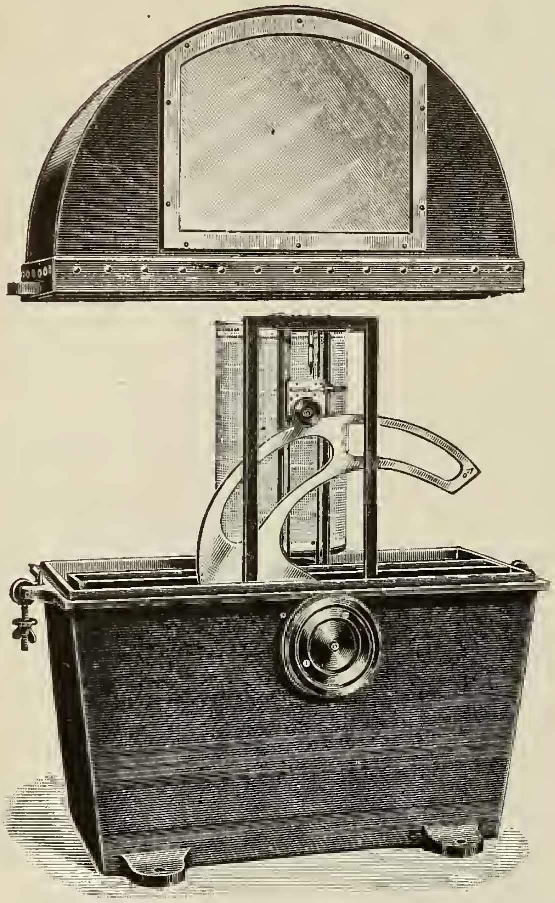
Write for Bulletin S.

ARMSTRONG MFG. CO.
Established 1867
Waterloo, Iowa, U. S. A.

Eastern and Export Office
17 Battery Place
New York City

Western Branch
3rd and San Pedro Streets
Los Angeles, Cal.

Canadian Branch: Drinkle Block No 2, Saskatoon, Sask.



CAM
RECORDERS

For recording the quantity of water or sewage flowing over a sill or through a notch. A strong, reliable instrument, not liable to derangement, and of the best manufacture and finish. Easily installed because no elaborate levelling is required.

Send for Book No. 6

which contains fullest information about all classes of Water Level Apparatus.

GENT & CO., LTD.
Leicester, England

We Manufacture

The Reliable Line
of

VALVES
- Brass Globe and Gate.
- Steam and Hot Water.
- Packless Radiator.
- Iron Body "Keystone" Gate, (non-rising stem or outside screw and yoke, with screwed, flanged or hub end)
- Iron Body Swing Check.

Kerr Gate Hydrant.

Gate and Compression
FIRE HYDRANTS

INDICATOR POSTS

CRANES FOR FILLING
WATER CARTS

VALVE BOXES
Screw Adjustable or Slide
Adjustable

Forty Years of Experience has much to do with the satisfaction these goods give our customers.

6" Hub End Gate

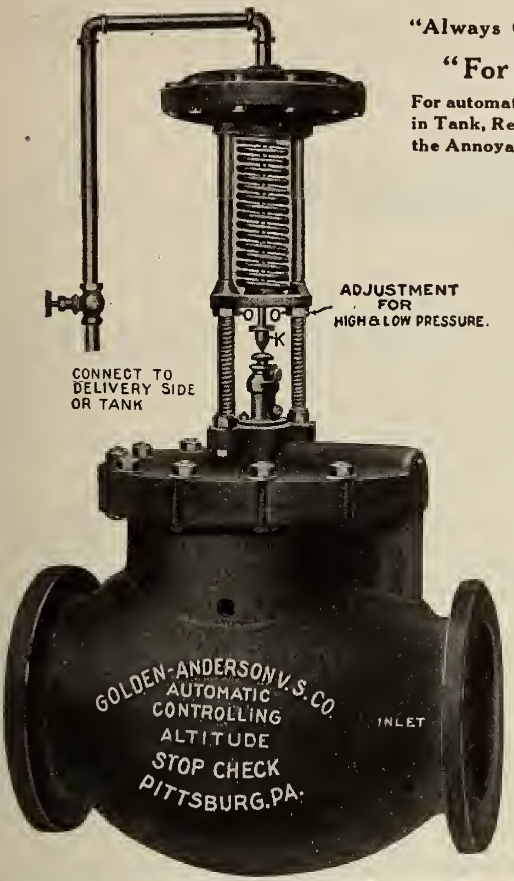
THE KERR ENGINE CO.
LIMITED
WALKERVILLE, ONT.

The Golden-Anderson Pat. Cushioned Controlling Altitude Valves

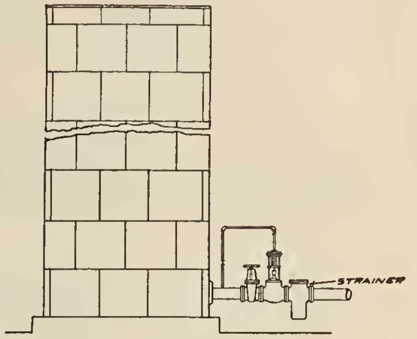
"Always Cushioned in Opening and Closing"

"For High and Low Pressure"

For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.


ADJUSTMENT FOR HIGH & LOW PRESSURE.
K
CONNECT TO DELIVERY SIDE OR TANK
INLET
GOLDEN-ANDERSON V. S. CO.
AUTOMATIC
CONTROLLING
ALTITUDE
STOP CHECK
PITTSBURG, PA.

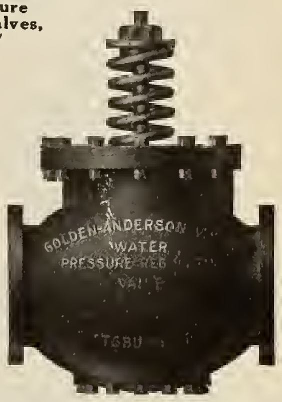
Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.



Automatic Cushioned Water Pressure Regulating Valves, up to 24"

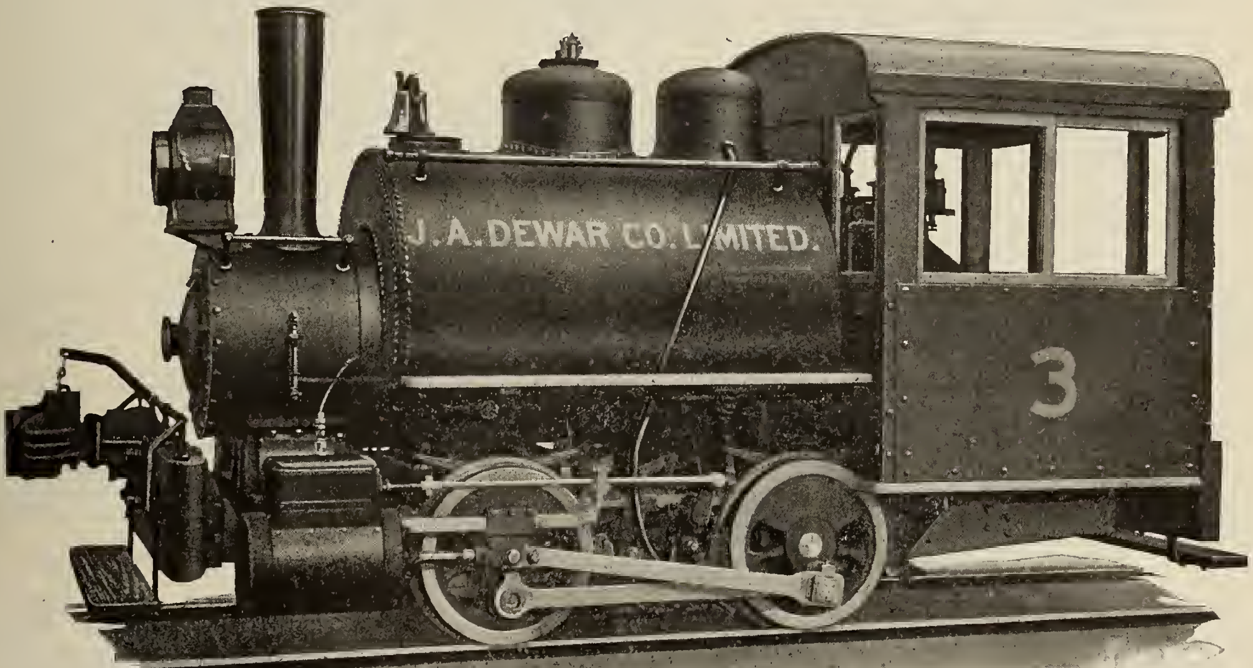
Golden-Anderson Float Valves

(Angle or Straight Way), up to 24"



Golden-Anderson Valve Specialty Co., 1247 Fulton Bldg. Pittsburgh, Pa.

CONTRACTORS' LOCOMOTIVES



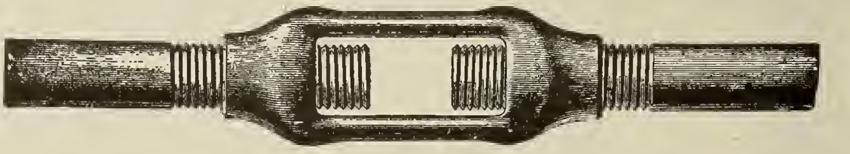
High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

Canadian Billings & Spencer, Limited

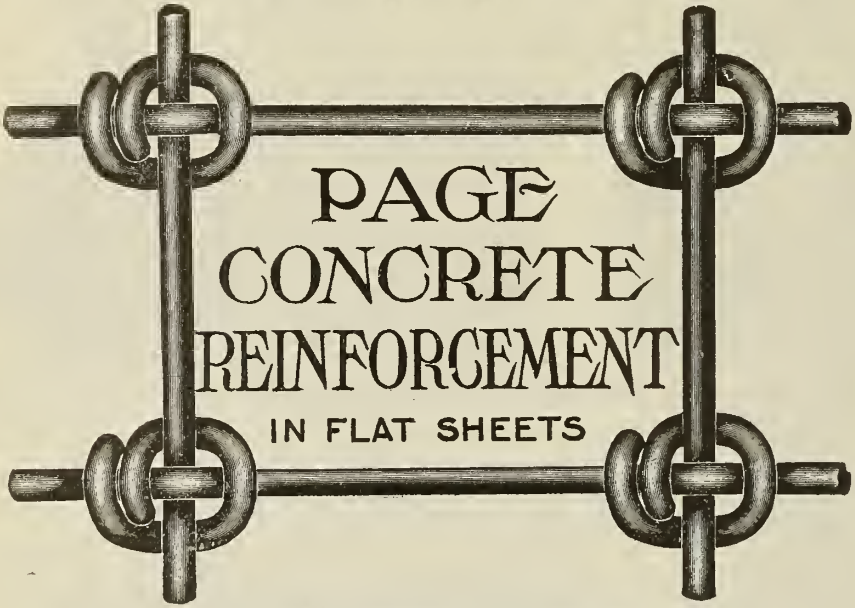
TRADE MARK



TRADE MARK

Full line of steel specialties for
Contractors and Builders

Welland, Ontario



Can be supplied in rolls if preferred.

PAGE Concrete Wire Reinforcement

for Concrete Road Pavement, Bridge and Building Floors

We are the originators of this wire reinforcement in flat sheets, and it is coming into universal use wherever introduced. We have supplied many carloads of it this season.

The standard mesh for road pavement is 6 x 12 inches; for bridges and building floors, the standard is 3 x 6 inches. All sheets 4 feet wide, and any length specified that can be loaded in cars.

PRICES per 100 sq. ft. delivered—6 x 12 mesh $0.75—3 x 6 mesh $2.25

Samples will be sent upon request.

The Page Wire Fence Company, Ltd., Walkerville Ontario

Branches:— Toronto Montreal St. John, N. B.

Sash Weights
and
Cast Washers

Manufactured by
Fittings, Limited, Oshawa
Montreal Winnipeg Vancouver

WELLS AND GRAY, LIMITED
Engineers and Contractors

Buildings and Construction Work
OF ALL KINDS
Reinforced Concrete a Specialty

Write us for preliminary plans,
estimates and photos of our work.

247 Confederation Life Building, TORONTO, ONT.

For Permanent Lines :

CAST IRON PIPE

for

Water and Gas Supply, Fire Protection, Road Culverts, etc.

30″ Intake, floated to position before lowering

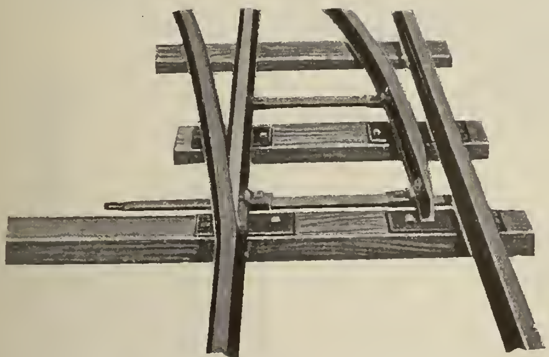
United States Cast Iron Pipe & Foundry Co.

General Offices :—BURLINGTON, NEW JERSEY

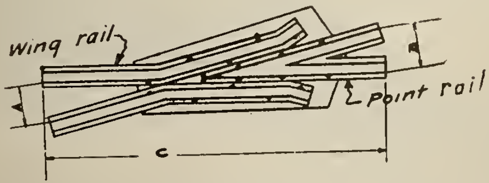
Sales Offices :—Philadelphia, Chicago, Buffalo, Portland, (Ore.,) New York, Chattanooga, Pittsburgh, St. Louis, San Francisco

A Practical Switch

Standard Ground Throw



Switch Points, Connecting Rods and Slide Plates



Rivetted Plate Frog

The Bechtel Policy

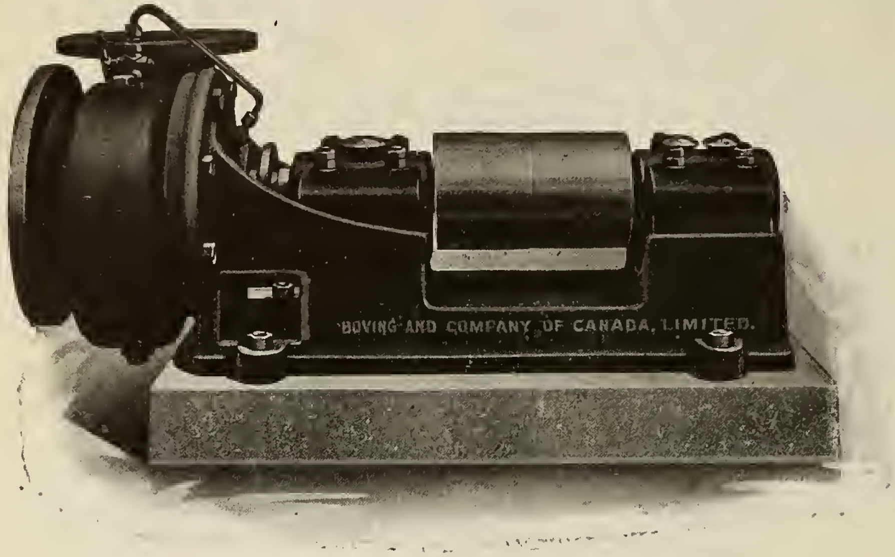
Simplicity and Strength

has been closely adhered to in the manufacture of the Switch illustrated. This switch is constructed for spiking to wooden ties, and consists of one throw, one frog, one pair points (spliced rails 4 ft. long) and two connecting rods with clips and four slide plates. If desired, the throws can be put out of use temporarily by turning up several inches of the extending parts of the first connecting rod, so that the points can be moved with the foot.

Full data and prices on request

Bechtels Limited

Waterloo, Ontario



J.O.B. CONTRACTORS PUMPS

Illustration shows 10″ Contractors Pump.

Belt Driven Low Pressure Pumps of Solid and Durable Design — Built for Heavy Duty.

Let Us Quote on Your Requirements

Pumps for all purposes
Belt Driven
Direct Connected
High, Medium and
Low Pressure

Boving & Co. of Canada Limited

Head Office: 164 Bay St., TORONTO
Works: LINDSAY, ONTARIO
MOOSE JAW: 94 Grafton Ave.
VANCOUVER: London Bldg.

Superior Construction

It spells longer life, less repairs, no breakdowns, constant service, greater output, and lower operating and mixing cost. On the next job use the

"INTERNATIONAL"

Concrete Mixers

GLOBE TYPE

Rosebery says:
"INTERNATIONAL" in the end—why not now?

Some New Improvements worth investigating:

Globe Drum, Steel Tracker Bands, Self Oiling Winding Drum and Tracker Wheels, Steel Chain Drive

Write to-day for complete Catalog No. 60-98 and prices.

Large stock carried for immediate delivery

10 sizes, 4 to 100 cu. ft. per batch. Any power.
Agents wanted in open territory. M325

Power & Mining Machinery Co.

MILWAUKEE, Wis., U.S.A. *Factory:* Cudahy, Wis.

CERESIT TRADE MARK

A Perfect Protection for Cement Stucco Exteriors

Ceresit in cement stucco protects the metal lath from corrosion, thus lengthening the life of the stucco. It also prevents afflorescence and discoloration, thus retaining the original beauty of the stucco.

The residence of Donald H. McGilvray, Chicago, (shown herewith) is one of many hundreds of buildings where Ceresit has successfully waterproofed and weatherproofed the stucco exterior.

Residence of D. H. McGilvray, Chicago, Ill.

Write for 1914 "Book of Evidence" giving complete facts about Ceresit.

Ceresit Waterproofing Co.

913 Westminster Bldg., CHICAGO

FACTORIES—Chicago, Unna, Germany: London, Paris, Vienna, Warsaw

LIST OF DEALERS—W. B. Poucher, Edmonton, Alta.; E. G. Cullen, Vancouver, B.C.; Walkers, Ltd., Winnipeg, Man.; R. deB. Carrite, St. John, N.B.; W. K. Macdonald Co., Toronto, Ont.; McLelland Peters Co., 305 Read Bldg., Montreal; The Whitlock-Riddell Co., Moose Jaw, Sask.; Brown & Chapman, Regina, Sask.; MacKenzie & Thayer, Ltd., Saskatoon, Sask.; N. G. DeHaas, Sault St. Marie, Ont.

—built with

Burlington Steel Bars

for CONCRETE REINFORCEMENT

Storage No. 2—capacity 2,500,000 bushels—of the Grand Trunk Pacific Terminal Elevator at Fort William, Ont., was built in 1912. John S. Metcalf Co., Ltd., Montreal, were the engineers, and it is through their courtesy that the accompanying photo is presented. Burlington Bars were used for concrete reinforcement for this elevator.

Burlington Bars have also been used for the C.P.R. Elevator at Port McNicoll, Ont.; Elevators No. 1 and No. 2 for the Montreal Harbor Commission; Maple Leaf Milling Co. Port Colborne Elevator; Wasdell Falls Dam for the Ontario Hydro-Electric Power Commission of Ontario; Section 2, Welland Canal (Baldry, Yerburgh & Hutchison); Canadian Westinghouse Co. additions to plant; Maple Leaf Milling Co. Medicine Hat Elevator; and on scores of other important contracts throughout Canada.

Rounds, Squares, Flats, Twisted Squares, Angles, Channels, T-Bars, Ovals, Half Ovals, Half Rounds, Bands and Special Sections; Cross Arm Braces; Pole Shims.

Prompt Shipment from Stock

Burlington Steel Company, Limited, Hamilton

Formerly "Canada Steel Company, Limited"

1000 feet a day for $1\frac{1}{6}$ cts. a foot total cost

No. 00 Austin Trench Excavator at Sioux Falls, S.D., digging a sewer ditch nearly 13 ft. deep. Bringing up 28 in. boulders.

And "taking things easy" at that! Yes, an Austin Trenching Machine No. 00, in Aurora, Illinois, U.S.A., worked for about 1 1-6 cents a foot cost, INCLUDING cost of operator, assistant, board bill of operator, some teaming, gasoline, lubricants and a few minor repairs.

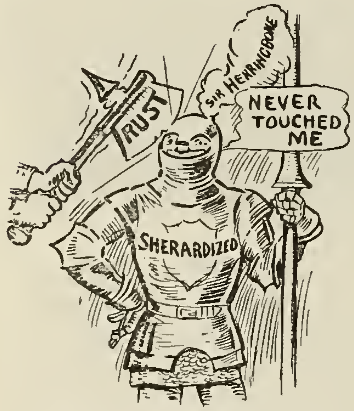
What secrets lie behind this phenomenal ability of Austin Trenching Machines? None. Simply GREAT care in attention to details, the elimination of the old-fashioned "shift mechanism;" the use of the **straight pull**; the buckets digging constantly the full width of the trench.

Austin Trenching Machines represent the culmination of a quarter of a century of actual practical working experience and close contact with the requirements of the contractor in the field.

Write to our Canadian Representatives—the one nearest you.
Lecky & Collis, Limited, 49 Beaver Hall Hill, Montreal; 43 Scott St., Toronto, and P. O. Box 611, Napanee, Ontario.
Canadian Equipment & Supply Co., Calgary and Edmonton. E. G. Cullen, 418 Pacific Bldg., Vancouver
Dominion Equipment & Supply Co., Winnipeg, Manitoba

F. C. AUSTIN DRAINAGE EXCAVATOR CO. Railway Exchange, CHICAGO, U. S. A.
Agents Wanted in Open Territory

Sherardized Herringbone Lath



Best Metal Protection

is protected by the very latest and best development in the art of galvanizing. Professor Burgess, Metallurgist of the University of Wisconsin, reports that it took him 304 minutes to dissolve in dilute acid, a given amount of filings from the sherardizing coating. It only took 20 minutes to dissolve the same quantity of filings from hot galvanizing.

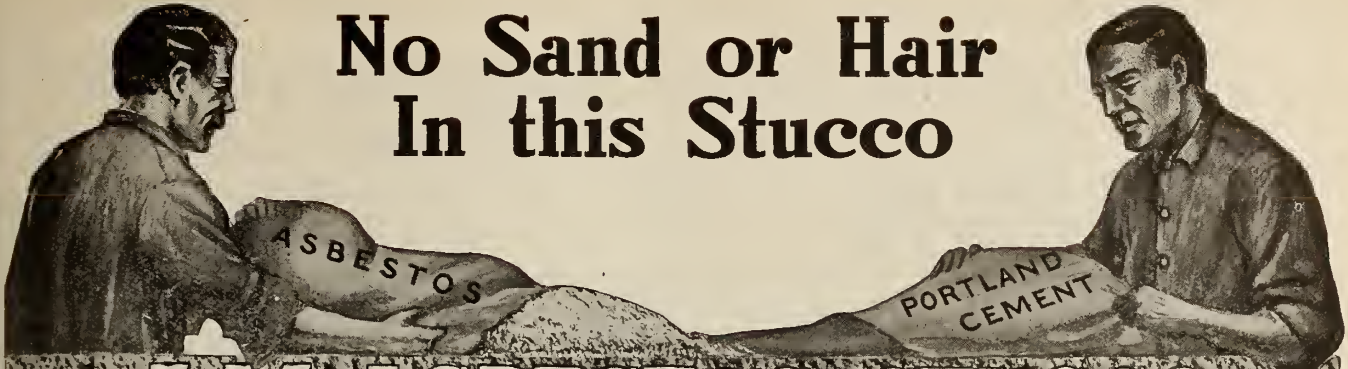
When you specify a galvanized metal lath you do so because you want the very best. Then why not specify the best galvanized lath—**Sherardized Herringbone?**

Clarence W. Noble, ***General Sales Agent***

117 Home Life Building, TORONTO

The Metal Shingle & Siding Company, Manufacturers

No Sand or Hair In this Stucco



J-M ASBESTOS STUCCO

The base of most stuccos is sand. And stuccos containing sand not only dry out a dirty dismal color, but also become stained and spotted from the iron and other mineral and foreign substances in the sand.

J-M Asbestos Stucco does not contain sand. Its base is tough asbestos fibres and finely ground asbestos rock. The fibres take the place of hair used in other stuccos, and the ground asbestos rock takes the place of sand. This, when combined with Portland Cement and hydrated lime, produces a stucco that can be applied in a variety of finishes and texture effects, and which dries a pleasing, permanent gray-white. In prepared form it can be furnished in various shades of gray, buff and brown. Being chiefly composed of asbestos, it is absolutely fireproof and a most efficient non-conductor of heat and cold.

J-M Asbestos Stucco is lighter in weight than most stuccos, and covers a greater area per ton. It is the most handsome, durable and economical stucco from every standpoint.

Write our nearest Branch for illustrated descriptive booklet.

THE CANADIAN H. W. JOHNS - MANVILLE CO., LIMITED

Manufacturers of Asbestos Roofings; Stucco; Pipe Coverings; Cold Storage Insulation; Waterproofing; Sanitary Specialties; Acoustical Correction; Cork Tiling, etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

1751

WHICH ARE YOU USING?

Steel Barrels and Trucks

Steel Shop and Tote Boxes

The old wooden boxes and barrels for handling and sorting material? How long do they last, and think of the time wasted in picking the stuff off the floor, when they break.

What 5 minutes a day, lost by one man, means in a year.

per day each man	1 man	10 men	35 men
1.50	4.35	43.50	152.25
2.00	5.80	58.00	203.00
3.00	8.69	86.90	304.15

Then think about our steel time savers, they are indestructible, fire-proof, space saving.

The Barrel Truck enables one man to lift 600 to 900 pounds with ease.

Any style Boxes, Cans, Steel Racks, Shelving, Lockers. Anything to meet your requirements.

CANADIAN STEEL PRODUCTS CO. **"THE STEEL SPECIALISTS"**

227-229 Wellington St., MONTREAL *Agents Wanted*

TELL US YOUR SHOP TROUBLES—WE ARE HERE TO HELP YOU

DON'T BUY REAL ESTATE,

MORRIS CHAIN BLOCKS

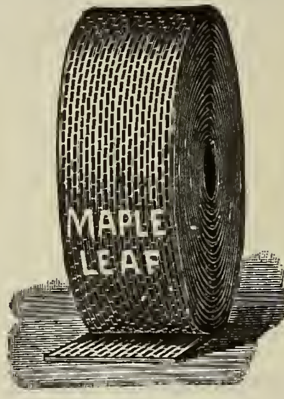
ARE A BETTER INVESTMENT.

THE HERBERT MORRIS CRANE & HOIST COMPANY, Limited.
EMPRESS WORKS PETER STREET, TORONTO

Looking for the "Maple Leaf"

Has Become a Habit with Superintendents and Engineers.

The reason is not hard to find, for there is no part of your Belting system, from the main drive to the smallest light Belt for power transmission, where you will not get the best kinds of service from



"Maple Leaf" Brand Stitched Cotton Duck Belting.

It is the most economical Belting because it is durable under every condition; even where other Belting will deteriorate rapidly. It is water proof.

It runs absolutely true on the Pulleys.

It is built of plies of selected duck.

Write for Information and Prices.

DOMINION BELTING CO., LTD.
Hamilton, Canada

Crystallized Comments on

ASBESTOSLATE ROOFING

Several thousand readers of one of Canada's leading magazines, "Everywoman's World," recently accepted an editorial invitation to tell candidly what they thought about ASBESTOSLATE—the fireproof and everlasting roofing of Asbestos and Cement. Here are a few of their interesting opinions:

"Asbestoslate Roofing is a great protection in time of fire. My father owns a number of houses and every one has an Asbestoslate Roof."
Mrs. A. S. Lucas, 399 King St. W., Brockville, Ont.

"My husband has used Asbestoslate Roofing and thinks it is alright."
Mrs. Chas. E. Hart, Madoc, Ont.

"I know of several builders who have used Asbestoslate Roofing, and it has proved most satisfactory in every way."
Mrs. J. H. Waddington, Combermere, Ont.

"I understand Asbestoslate is being used for the Dry Dock buildings here. This is a great recommendation, as the Dry Dock is to be one of the largest and best in America, and only the best materials are being used."
Mrs. J. C. Halsey, Prince Rupert, B.C.

"We have used Asbestoslate and like it splendidly."
Mrs. P. F. McCully, James River Sta., N.S.

"Asbestoslate Roofing is on a house we have just moved out of, and we have never known it to leak."
Mrs. E. Mosher, 2 Kingswood Rd., Balmy Beach, Toronto.

Such disinterested opinions are certainly worthy of your careful consideration
Write for full information and samples of Asbestoslate to Dept. C. R.

ASBESTOS MANUFACTURING CO., Limited
Address: **E. T. Bank Bldg., 263 St. James St., Montreal.** **Factory at Lachine, P. Q.,** (near Montreal)

Do not fail to visit our Asbestos Bungalow at the Canadian National Exhibition Toronto, August 29 to September 14.

Results of the Great Ohio Floods in One City—No. 1

This series of pictures of which the accompanying is the first will be published with brief explanations in Tiffin Wagon Co. advertisements through a series of eight or more views. This belated publicity, which we believe will prove interesting, is given because little was known at large of the destruction of property, the loss of life and the general smashing blow received by Tiffin, Ohio—where our factory is located.

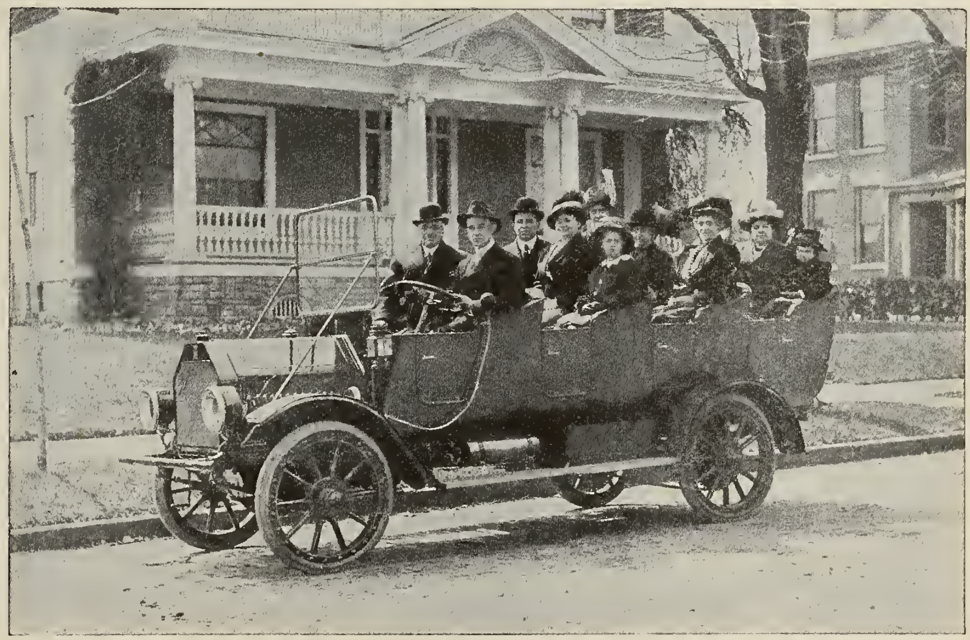
Herewith is shown the nearly completed modern bridge that supersedes one of five bridges swept away by the 1913 flood. Tiffin Dumping Wagons were used in the construction work and never failed to stand up—all Tiffin products are staunch and good.

A New Idea in a Passenger Carrying Motor Vehicle

We are going to let this picture of the Tiffin II Passenger "County Club" Car, built on Tiffin Motor Truck Chassis, speak for itself.

Where else can you find a passenger carrying car that has pleasure car lines and the other advantages so apparent in this absolutely new design?

Write for literature

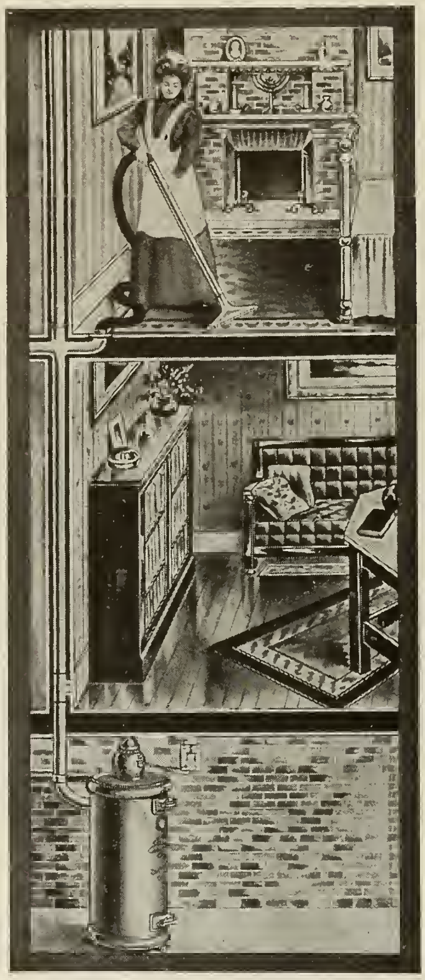


TIFFIN

WAGON COMPANY

TIFFIN, OHIO

Builders of Farm and Dumping Wagons, Street Sprinklers, Flashers, Motor Trucks, etc.



The Standardized Cleaning System

Up to three years ago, fourteen manufacturers built and sold ninety per cent. of all the Stationary Cleaners on the market. Today, most of these same fourteen manufacturers are still in business, and are augmented by several additional concerns, but the sales of the **TUEC** now comprise seventy-five per cent. of all stationary cleaners sold in North America.

CANADIAN TUEC DISTRIBUTERS
TUEC COMPANY OF VANCOUVER—601 Pender St. W., Vancouver
TUEC COMPANY OF ALBERTA—105 Sixth Ave., Calgary
TUEC COMPANY OF WINNIPEG—505 Boyd Block, Winnipeg.
TUEC COMPANY OF MONTREAL—406 New Birks Bldg., Montreal

Canadian Factory:
B.O.T. Bldg., 159-161 Richmond St., West
TORONTO, ONT.
James J. Martindale

All Over North America the popular RED Brick is

"PRESSED BRADFORD BRICK"
(TRADE MARK REG. U. S. PATENT OFFICE)

Their destinctive, non-fading redness appeals to persons of discrimination.

"Bradford Reds"

the trade name for our smooth brick, made both dry pressed and impervious.

"Bradford Ruffs"

Our rough-textured brick for bungalows, grills and fine rustic effects.

Write for the RED Catalog.

Bradford Pressed Brick Company

"The Red Brick People"

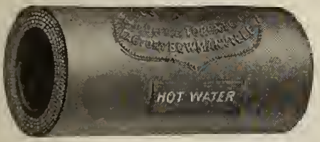
BRADFORD, Pa.

Hose for Every Service

There is a big difference between hose price and hose service. One is what you pay, the other is what you get. A hose that soon gives out is dear at any price. It isn't so much a matter of buying new hose as of impaired service—the financial loss that "price" hose brings.

That is why the best hose is imperative. That is why buyers of hose should buy Goodyear—the kind made for service rather than to meet a price. When service suffers good money goes.

For the building field there are various brands of Goodyear Hose that cover every exact requirement—from steam and water hose to pneumatic tool hose.



GOODYEAR
TORONTO

Goodyear Steam Hose

This is an unusually high grade hose, made with a special steam, heat and oil resisting tube. Rapid hardening cannot occur. The steam cannot force its way through the sides. The tube cannot "cook" to death like ordinary hose.

Goodyear Steam Hose also has an oil resisting tube. This hose has been tested for 1446 hours at 100 pounds steam pressure with oil injected, without being affected by the oil in any way. This hose also comes wire wound. This gives it long life under rough and continuous handling. The wire winding protects and keeps the hose intact even under severe abuse.

Goodyear Pneumatic Tool Hose

Goodyear Pneumatic Tool Hose represents a service that amply fills every requirement. It has a special oil resisting rubber lining of super quality and comes either marline or wire wound.

The tube is oil proof. Air under compression is saturated with oil which collects on the tube. The composition of Goodyear tubing is such that it resists this deteriorating action which so quickly ruins ordinary hose.

The tube will not swell or disintegrate. Free air passage is always allowed.

Consult Goodyear Experts

Whenever you want rubber hose for any purpose, remember that Goodyear experts have designed the very hose to meet the very condition.

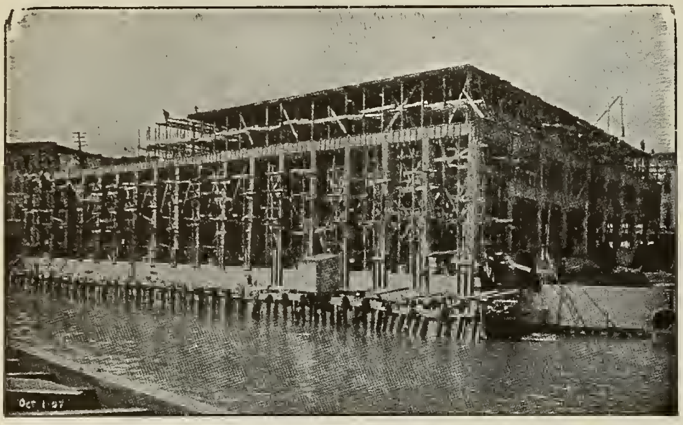
Confer with these men. It costs nothing to ask questions—to learn why such and such a Goodyear Hose meets its particular purpose.

Goodyear also makes a full line of rubber belting, hose and packing for every service. All made at the Goodyear Bowmanville, Ontario, factory—made under the same quality standards that have won Goodyear leadership in automobile tires.

The Goodyear Tire & Rubber Co. of Canada, Limited

Head Office, Toronto, Ont. **Factory, Bowmanville, Ont.**

Branches at Victoria, Vancouver, Edmonton, Calgary, Regina, Winnipeg, Hamilton, Ottawa, Montreal, St. John, N.B.



The Bostwick Brown Building

A Test of "MEDUSA" WATERPROOFING

The basement floors of the building illustrated are 20 feet below the surface of a river. These floors and walls are of concrete, waterproofed by "Medusa" Waterproofing. The result is a perfect dry basement, and one which will always be dry. Surely this is a severe test of a waterproofing compound.

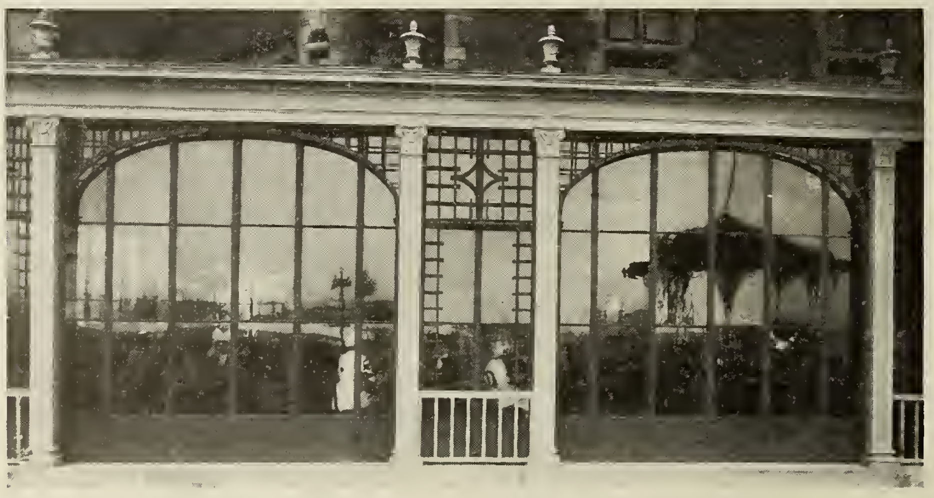
Send for Samples and Prices

Manufactured under Canadian Patent controlled by

Stinson-Reeb Builders' Supply Co., Limited

9th Floor, Read Bldg., 45 Alexander St., MONTREAL

Architectural Bronze and Iron



Illustrating ornamental iron and steel folding storm sash, Summer Cafe, Chateau Frontenac, Quebec, facing Dufferin Terrace. Work includes eleven large panels of ninety folding steel doors, twelve small panels and twenty-five columns.

Contract signed April 20th 1914, ornamental iron furnished and erected complete on June 1st.

ESTEY BROS., COMPANY

Canadian Office and Works, MONTREAL **Head Office, NEW YORK**

Branch Offices—N. J. Dinnen & Co., Winnipeg, Calgary, Vancouver **Scott, Hammond & Pratt, Toronto**

ESTABLISHED 1886

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Canadian Constructional Activity—Retrospective and Prospective

WARS and rumors of wars notwithstanding, we find something to be thankful for in the constructional activities of the first half of 1914. In a time of business uncertainty like the present it may be well to take fresh heart by looking at a few figures squarely in the face. Such examination at least gives us sufficient ground for believing that the constructional projects to which the various interests in Canada have committed themselves will provide reasonable activity for the remainder of the season.

Taking the thirty cities of Eastern Canada from which returns are available, we find that building permits totalling in value $36,985,766 were taken out in the first six months of the present year, as against $40,902,521 in the same period of 1913. Thus a decline of only 9.5 per cent is shown. In 1914, from January to June 30, the estimated value of new buildings in Montreal was $8,521,910, while for the same period last year the figures were $9,942,286—a decrease for the current year of some $1,400,000. Although there is a decrease in value there is an increase in the number of building permits taken out. An examination of the figures for Toronto discloses the fact that the two corresponding half years are practically equal. The number of building permits issued from January 1 to July 31, 1913, was 4,470, while for the same period this year the total is 4,901—an increase of over 400. It is gratifying to find that more building permits were issued in Toronto during July of this year than in the corresponding month of 1913, the figures being, July, 1914, 997; July, 1913, 783. In the Western cities of Canada a decline of only 3.8 per cent in the value of buildings under construction is recorded. Taking the forty-seven cities of Canada from which returns have been received, there is a reduction of 20.8 per cent.

Regarding the financial status of the Dominion, a note of encouragement is found in the fact that there is as much ready money in Canada to-day as ever before. Savings deposits increased from $398,000,000 in 1908 to practically $664,000,000 in 1914—every year having shown a substantial increase. The money situation has been the subject of wide discussion all over the Dominion and leading authorities are agreed that Canada is as generously supplied with money today as ever in the past.

Glancing over the record of building in the forty-three cities of the Dominion, we find that constructional activity during the last six months has been on the increase in eighteen cities, the most noticeable increases having been recorded at Winnipeg, Medicine Hat, St. Thomas, Ont., St. Catharines, Berlin, Quebec, Maisonneuve and Halifax.

Crop conditions in the Western provinces are generally reported excellent.

Optimism has ever been a strong characteristic of the Contract Record, but optimism, like everything else carried to excess, "begets peculiar pain" sometimes. For some time business conditions have not been what they might have been, and now that Great Britain is entangled in a general European war it is hardly likely that any rapid improvement will come about. It is reasonable in such a time as this, however, to take heart from the past achievements of empire and country and pursue our way quietly and conservatively in the calm confidence of ultimate success. No foreign power can stem the tide of Canadian development while British prestige is maintained and surely we have sufficient justification for believing that Canada's destiny within the empire is beyond the reach of an army of kaiser wilhelms. The trade depression which existed before the war was of a shallow character. For the present we are persuaded that the wise policy is to lie in wait patiently, avoiding wild retrenchments which must re-act subsequently upon ourselves.

Engineering Topics in the Old Land

British Trade in Canada—The Currency Question—Cost, Efficiency and Time, Factors of Primary Importance—The Fetish of Numbers —"Road Machine" a Crank Invention—"The Times" at Fault

London, Eng., Correspondence of the Contract Record and Engineering Review.

"British Trade in Canada"—an editorial which appeared in the "Contract Record" of June 17th—has aroused considerable interest "on this side." The currency question is always one which must loom large in international relations until a universal standard is adopted, and the time has long passed when at least English-speaking nations should have arrived at a common currency. To the English business man the dollar is as confusing as the anna and the rupee, and seekers of appointments in the Indian Empire (it is worthy of note) are always fearful of being "diddled" when the emoluments are set out in what is to them a foreign coinage. The dollar remains practically constant, and the rough and ready rule here is to divide the number of dollars by five and call the result pounds, (some seven-pence halfpenny in the pound being thus left over to the good); but the converse operation is not quite so easy. This is beside the question as dealt with in the article mentioned, however. In that the action of British manufacturers in sending out catalogues and price lists containing quotations in English currency was deplored, and it was said "This has been a source of much trouble to Canadian business men. In cases, owing to deductions allowed for discount and other charges, they have been obliged to consult the Customs authorities on the question of adjustments. It is difficulties such as these that cause the Canadian agent to look upon British agencies with less favor." It certainly seems surprising, but it is none the less true, that a great percentage of English people do not realize the difference in currency of the two countries. America and dollars are synonymous terms; but it is not so with Canada, which is regarded by such misguided people as a variant on Australia, and included within the comprehensive expression—the Colonies. Anyway, think these worthy people, both currencies are in use in Canada, as witness the money orders which are often worked out in dollars and in pounds, shillings and pence.

Tenths, Twelfths and Sixteenths

In matters commercial, elimination of unnecessary complications is all-essential. A universal standard of currency the world through must await the Millenium, but if England had not been the most conservative of nations the decimal system would long ere this have superseded the intricate system of values, weights and measures that is no system at all. English-speaking countries should be able to trade upon a common basis, and that basis must inevitably be dollars and cents. It is too late now to consider whether the decimal system is the best that could be devised. In the opinion of the writer, the duodecimal, working in twelfths, would be a considerable improvement. Twelve is divisible by two, three, four and six; ten is divisible by only two and five. The natural way of partition is by halving, and regarded from the point of view sixteenths would be preferable to twelfths; but duodecimals are already largely used in calculations, by, among others, English-speaking engineers, architects and builders. It is but seldom that one divides an article into tenths. Halving is, as has just been said, the natural method of breaking up, and one thus gets halves, quarters, eighths, sixteenths and so on, each fraction increasing the difficulty of decimal representation. This again, by the way; although the matter is one which might be discussed with advantage from the standpoint of the engineer. Perhaps those readers of the Contract Record with whom mathematics is a strong point might commit their views to writing.

Cost, Efficiency and Time

Much, far too much, has been written and spoken concerning the relations between Canada (and other countries) and the mother country. Sentiment is to be encouraged, provided it rings true; and as much may be argued for patriotism. Dr. Johnson is said to have defined patriotism as the last resource of a scoundrel, and the definition has certainly a substratum of truth. Only too often is the Union Jack waved in one hand merely for the purpose of diverting the attention from the other hand which is wandering into strange pockets. The Union Jack is but a poor commercial asset when dealing with civilized nations. Backed up by guns and a field force, it certainly "promotes" trade in savage districts; but then there is no competition to meet in such places, except perhaps that of the medicine man or witch doctor. "In this competitive age," says the article in the Contract Record, "cost, efficiency and time are factors of paramount importance. The purely sentimental regard that the British have for the British is a matter of small count when it comes to dollars and cents—and service." If England can buy wheat of similar quality a farthing a quarter cheaper from Russia than she can from Canada, further argument is at an end. Unfortunately this solid fact has not been fully recognized, and the English trader has relied too much upon the Union Jack in the pushing of his wares, neglectful of the factors of "cost, efficiency and time." It is a worthy object to strive for "the improvement of trade relations between the mother country and the Dominion." Canada is "a land of great opportunities, and her prizes are worth the winning," but "they will be offered for the best service, irrespective of whether that service comes from Canada, the United States or Great Britain."

The Fetish of Numbers

The address of Mr. H. N. Ruttan, retiring city engineer of Winnipeg, to certain Winnipeg engineering students, brings to the mind very forcibly the necessity for more frequent intercourse between municipal engineers. Conventions and conferences on a big scale are well enough in their way as show pieces, but there is little of a practical nature to be derived from them. The numerical strength alone of these gatherings militates against their usefulness, and resolutions and amendments are a very harsh form of diet. Too much respect is in fact paid to the fetish of numbers. "The more the merrier" should not apply in the case of the professional society meeting. Selection should then be the criterion, and five or six assembled together might carry through a most useful programme. Meetings would be called much oftener were secretaries not afraid of what is termed a bad attendance, and yet when a big number does meet, actual business has to be referred to committees and nothing much else is ever done except to receive the report of committees that have been appointed at prior meetings. If five or six was regarded as a satisfactory attendance, many hundred more meetings would be held annually, and the profession would benefit correspondingly. In many parts of Canada, where communities are scattered at vast distances apart, large meetings of those in the same profession or calling are impossible. Why not then let two form a quorum?

The "Road Machine"

Someone has been pulling the leg of "The Times." In a contributed special article "Model British Roads," fulsome praise is bestowed upon a crank invention known as the "road machine," which has been fixed up at the National Physical Laboratory at Bushey. The machine is referred to as "an interesting innovation for testing the durability of new road materials. It consists of a track, 100 ft. in length, in circular form. On this the engineers can lay down any piece of roadway which they wish to test. A motor-driven framework on eight wheels, which is loaded to any desired degree and run at any desired speed, is then driven over this experimental stretch so as thoroughly to test its durability. By this device the engineers are able in a few months to test the quality of any new material or any new design or roadmaking just as thoroughly as if it had been laid down for eight or ten years. As no new system of road treatment can be relied on until it has been subjected to actual trials, the time saved by the machine has facilitated considerably the new developments of recent years." The article was written possibly by the inventor of the machine or by one of the scientists of the Laboratory (Colonel Crompton, mayhap), or it might even be from the pen of the gentleman (well known in road circles here) whose articles on road carpets and road crusts speedily leaped into popularity owing to their having no vestige of practicability. To the mind of any of these three the machine would strongly appeal as being eminently unpractical. But to the engineer —the man who has to make roads and not merely to tinker with petty idiosyncracies concerning their make—the machine is a laughing-stock, the "actual trials" a farce, and the "facilitation of developments" a snare and a delusion. And "The Times" devotes a half column leading article to a flattering substantiation of the statements in its contributed article! May it be hoped that "our friends on the Continent who are coming to us to learn how road-making is done" will estimate the work of the "road machines" at its true value, and not be led away by obvious "puffs."

The Deposit Cheque

IN the Contract Record for July 15 we related how the deposit cheque of a Toronto contractor was refunded in spite of the Mayor's unqualified disapproval of such procedure. The Mayor contended that such a policy encouraged collusion among contractors. Among our readers His Worship has one supporter in Mr. Chas. Curtis, President of Western Pavers, Limited, Winnipeg, a gentleman of extended experience in large contracting operations. Mr. Curtis writes us: "I am of the opinion that Mayor Hocken was right in his contention that the deposit cheque should have been forfeited. The sooner such forfeiture is put into effect the sooner municipalities will get rid of 'the catch-as-catch-can contractor.' In Western Canada—not in Western Canada alone—one encounters many contractors whose whole ambition is to tender below the other fellow and run chances on getting through the job at a profit. These are the contractors with whom it is in the best interests of the municipality to avoid dealing as there is too great a tendency to skimp the work when an opportunity arises. By returning the deposit cheques to such contractors it is simply an invitation for them to take another chance. In respect to collusion, however, I am not in agreement, as the object of having the Commissioner of Works submit a tender is to prevent concerted agreements and the Commissioner surely figures his estimates of cost before submitting his tenders, otherwise they can be of no more value than those of 'the catch-as-catch-can contractor.'"

Profitable Conversion of City Garbage

A method of garbage disposal which is finding considerable favor in England and which has been adopted amongst other towns in Southwark, Hove, Halifax, Blackpool, etc., consists in converting the house refuse collected by municipalities into a marketable fertilizer. The plant, as described by a correspondent of Municipal Engineering, comprises a patent disintegrator or dust manipulator, a conveyor and an electric motor for driving. At Southwark, London, there are four sets of the machinery which are erected in pairs, the two pairs facing each other, the conveyors conveying towards the centre and discharging the output into a railway truck for immediate dispatch. The whole space occupied by the plant is only some 50 feet by 20 feet and no costly buildings are required. The machine which actually does the work is the dust manipulator which is a strong and powerful centrifugal force disintegrator. The dust carts tip their loads on a sheltered platform some 20 feet by 12 feet, where large tins and leather, which fetch a good price, are thrown aside by the workmen, while the remainder, including broken glass, crockery, slates, wood, and small tins, in one word, the whole of the unpicked refuse, is shovelled into the hoppers of the machines for treatment. In a second or two after entering the machine the house refuse finds its way out and falls on the conveyor in a uniform mass which cannot well be distinguished from dark, rich loam. Occasionally, a few very small bits of paper appear here and there on the surface, but these dis-appear very quickly owing to the disintegrating action of a rapid fermentation accelerated by the pounding the refuse received while passing through the machine. One very noticeable point is that immediately after treatment this mass, which previously had a most unpleasant smell, has entirely lost it and is not objectionable. The stuff thus treated is now ready to be spread at once on the soil as manure. Of the four dust manipulators at Southwark three are in constant use, one being kept in reserve and used when wanted. The output amounted to some 70 tons a day, and the manure sold by the council to farmers and kitchen gardeners in Kent amounts to something like 18,000 to 20,000 tons a year. This manure is sold at 2s. 4d. (56½ cents) a ton. Each machine is capable of treating up to 4 or even 5 tons of refuse an hour. The whole operation is performed in a manner cleanly, quiet, and free from any suspicion of nuisance, and the economical principle of giving back to the soil what comes from the soil is put into practice.

Burned Asphalt Cement Can Be Prevented

FEW contractors realize the seriousness of burned asphalt cement and the amount of money lost through this cause. Pavements crumble away and yet hardly any attention is paid to this particular cause of their crumbling. Hardly any contractor would risk using hydraulic cement in his concrete that he knew had been spoiled, because common sense would tell him that he might have to take all the concrete up again, and yet he seldom stops to think that his asphalt cement may have been burned and therefore spoiled, and that he may have to take up his course of top and binder as a consequence. Experience has proved that when steam at a pressure of 125 pounds and without superheat is used in coils placed across the kettles, the asphalt cannot exceed 350 deg. F. and in kettles properly constructed for the purpose, the heating of a large mass of asphalt takes much less time by this means than with furnace heat applied to the exterior of the kettle at a temperature of at least 1200 deg. F. Also, no burning takes place; whereas, in the case of furnace heat at 1200 deg. F. all asphalt coming in contact with the part of the kettle nearest the furnace is burned in spite of any agitation given it. Where furnace heat is used, the vital operation of heating the asphalt cement generally depends upon the intelligence of a $3.50 per night colored man. He, as a rule, is no more conscientious than an average hired laborer, and as the superintendent cannot work 24 hours every day and watch the night work as well, takes frequent advantage by sleeping during the night and then firing very heavily towards morning to have the A. C. hot enough for the morning. This cannot occur with steam heat. It has also been proved that steam heat is more easily regulated and the resultant penetrations have been more regular as a consequence.

Asphalt manufacturers are adopting steam heat more and more every day as they realize the danger of furnace heated kettles spoiling their products.—Municipal Engineering.

The lowest grade considered satisfactory for successful operation of flumes is approximately 1 per cent, but it is better to maintain a grade of from 2 to 5 per cent when possible, according to a statement by E. S. Bruce in Bulletin 87 of the U. S. Department of Agriculture. The maximum grade that can be used runs up to a very high pitch. Some flumes have been successfully operated for a short distance at a grade of 30 deg., but such a steep grade is undesirable as it is difficult to maintain a sufficient volume of water in the flume. The most satisfactory results in fluming are obtained at grades of from 2 to 10 per cent, and grades above 15 per cent should be avoided whenever possible.

Sewer Excavation With a Revolving Shovel

A Washington contractor has been operating a revolving shovel for digging sewers in and about the city of Washington. The success which he has attained makes it well worth while to study his method of operation.

The shovel is equipped with a 27-foot handle, enabling it to dig to a depth of 18 feet, below the bottom of the wheels. The dipper has a capacity of ⅞ of a cubic yard. It is fitted with five forged teeth, three on the front, and one on each side. These teeth are intended as side cutters in order to assure sufficient clearance to lower into the ditch easily after a cut has been made. The neatness of the ditch cut is very noticeable.

This machine has been used recently for digging ditch for sewer pipe and also for concrete and brick sewer. The most recent job was a ditch for an 18-inch sewer pipe. This ditch is 3,300 feet long, varying from 10 to 27 feet in depth. The material is hard clay with a little shale at the bottom. As some of the work was done when the bottom was somewhat frozen the digging was very hard.

For the concrete and brick sewer, the shovel excavated a trench 18 feet deep, seven feet wide at the top and an average of five feet at the bottom. This sewer had a concrete invert and a brick arch. The speed of the building invert and the brick arch governed the whole progress of the work. The shovel under these conditions made about 65 feet advance a day, but this naturally is not an index of its capacity.

The material was loaded into two-yard side-dump cars travelling on light rails laid alongside the trench. This material was hauled back and dumped directly into the backfill. This method was pursued whenever possible. In a few places, however, owing to local conditions, it was necessary to overcast a small amount of material, which was later rehandled. The excess material not required for backfill was taken away in wagons. The bracing of the trench was put in by hand and small jack screws at the ends of the blocks held the sheeting in place. Two men were used for pushing the cars, although at times a mule was employed.

The concrete invert was laid immediately back of the shovel in the trench dug by the shovel on the preceding day. The brick arch was built on the second preceding day's invert and was allowed to stand a day before the backfill was placed upon it. This, as will be seen, left 200 to 300 feet of open excavation. Hence it was necessary only to keep the shovel ahead of the concrete gang. The organization of the job was so well planned, that a very few men were employed.

The shovel is mounted on traction wheels, to which are rivetted circumferential bands formed of channel iron, which give a double flange on the wheel. The shovel runs on rail sections about three feet long, mounted on 12 x 12-inch timbers. These timbers, seven in number, span the trench. They are in reality long chair ties. In order to move forward a chain sling, hung over the dipper handle, was hooked into I-bolts in the chair ties, or timbers.

The Various Types of Movable Bridges*

A Comparison of the Many Modifications of Swing, Bascule, Direct-Lift, Pontoon and Transporter Bridges and Their Bearing Upon Transportation: Features of Design and Adaptability to Varying Conditions.

By W. M. Wilson†

PART II.

THE double leaf bascule span of the Rhode Island stone bridge over the Sakonet River, between Portsmouth and Tiverton, R.I., is of a very similar type. Instead of making use of cables the front end of the moving leaf is supported by means of struts, which are pivoted to a carriage running on a curved track supported on a tower over the approach span. The carriage carries the counterweight and the track is so curved as to cause the bridge to be balanced in all positions. When the bridge is closed the carriage is brought up against a bumper so as to enable the pivoted strut to support the front end of the moving leaf under the action of the live load. The design was made by Mr. Augustus Smith, of New York. The bridge was completed in 1908.

One of the competitive designs submitted for the bridge over the Calumet River at 95th street, Chicago, is a double leaf bascule bridge, for which the moving leaves are supported by cables which pass over pulleys on the top of towers. Attached to each pulley is a large spiral over which passes a cable that supports the counterweight. The counterweight slides between vertical guides and the spiral is so formed that the moving leaf is balanced in all positions. This design was submitted by the Milwaukee Bridge & Iron Works in 1900.

A steamboat striking the pivot pier of the swing bridge which carried the New York Central and Hudson River R. R. over the Harlem River at 135th street, New York, a point where the traffic is congested, while not putting the bridge out of commission impressed upon the officials of the road the desirability of having an emergency draw span to be used in case the regular span should be out of commission. A bridge was put in place of the fixed span adjoining the swing span. It consists of a double track plate girder span hinged at one end and resting upon a pier at the other. Cables fastened to the outer end of the moving leaf pass over a wheel supported on a tower, down to and around the drum of a hoisting engine and thence up and over wheels at the top of the tower. Weights hung on the end of this cable balance the bridge. There are two sets of these weights and each set is made up of 23 parts placed one upon another. The cable passes through holes in the centres of the top 22 weights and is fastened to the 23rd

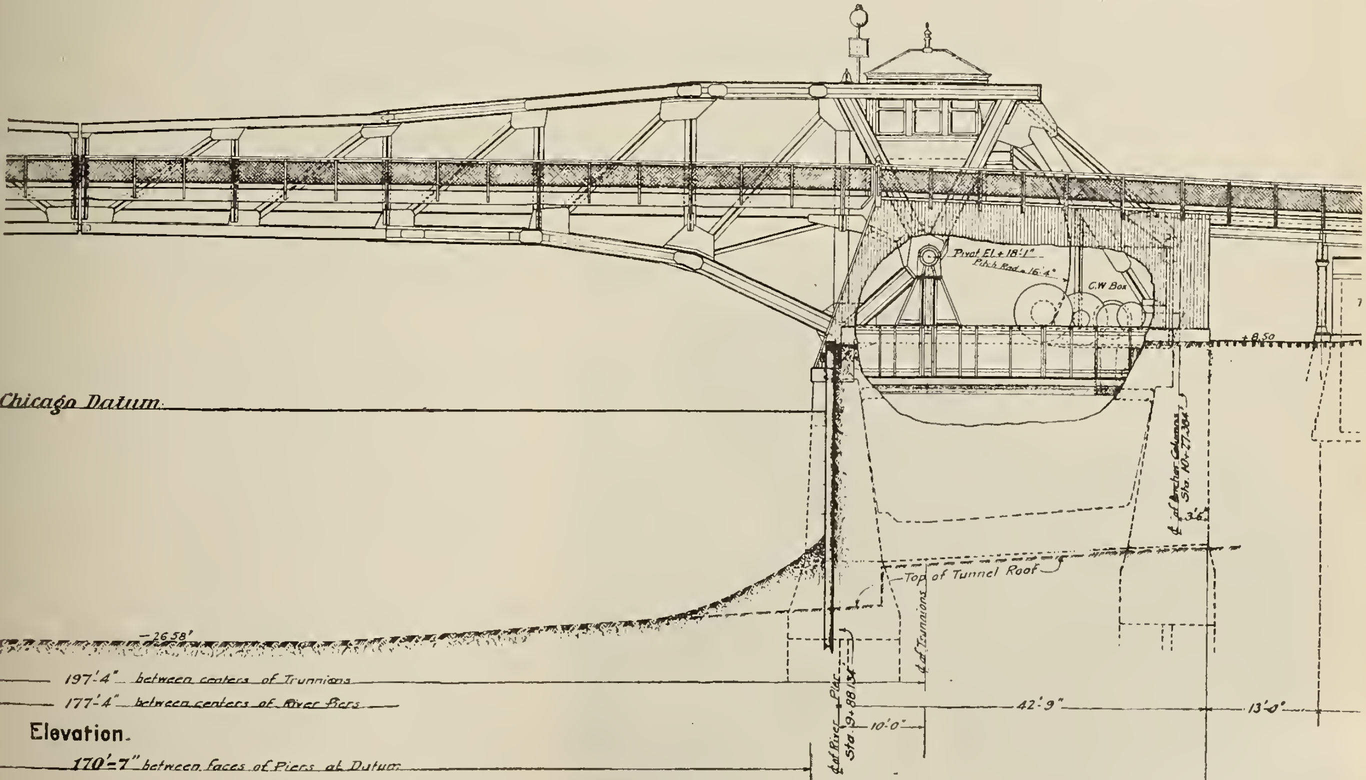
Pivot El. + 18'1"
Pitch Rad. = 16'4"
C.W Box
+8.50
Chicago Datum
-26.58'
℄ of Anchor Columns Sta. 10+27.384
3'6"
Top of Tunnel Roof
℄ of Trunnions
℄ of River Pier Sta. 9+88.134
197'-4" between centers of Trunnions
177'-4" between centers of River Piers
Elevation.
170'-7" between faces of Piers at Datum
10'0"
42'9"
13'0"

Fig. 10—Part of Washington street trunnion bascule bridge, Chicago.

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† Assistant Professor of Structural Engineering in the University of Illinois.

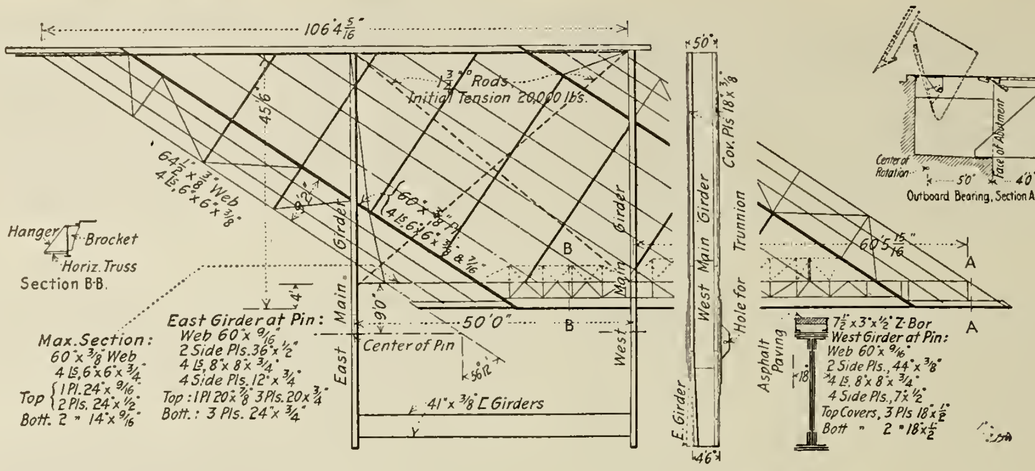


Fig. 11—Skew bascule bridge at salina street, Syracuse, N.Y.

weight. Brackets project from the weights and engage projecting angle supports on the tower provided for the purpose. These supports are so arranged that one after another of the weights is removed as the counterweight is lowered so that just enough remain on the cable at each position to balance the bridge. The bridge was designed by Mr. G. H. Thompson, then Engineer of Bridges for the N. Y. C. & H. R. R. R. It was built about 1892, and was afterwards used as a temporary bridge during the reconstruction at Spuyten Duyvil Creek.

The jack-knife type of drawbridge was used over the Chicago River at Weed street, Chicago. The bridge is composed of two similar leaves. Each leaf is made up of two parts connected by a hinge. Steel rods extend from the top of a tower to the outer end of the leaf and steel cables from the top of the tower to a point near the hinge connecting the two parts. The rear part of the leaf is pivoted on a fixed trunnion near its centre. A counterweight hung from the end of a steel cable passes over a pulley and over a cam. This cam is fastened to a shaft which also carries a drum. A steel cable fastened to this drum passes over and is fastened to a segment which is rigidly attached to the rear portion of the moving leaf. The radius of the cam varies so that the bridge is balanced in all positions. The operation of the bridge is as follows: When the bridge is closed the front end and hinge of the moving leaf are supported by rods and cables respectively passing up to the top of the tower, and the rear portion of the moving leaf is supported on the trunnion. In opening, the rear portion of the moving leaf turns upon its trunnion. The hinge joining the two parts of the moving leaf moves in a circle about the trunnion, and the front end of the moving leaf moves in a circle about the top of the tower. This motion causes the middle of the moving leaf to go up and the two ends to come down, leaving the channel clear between the towers. It was invented by Mr. Wm. Harman and was opened for traffic April 18, 1891.

A bascule bridge over the Cuyahoga River at Cleveland, Ohio, which was built in 1907, was designed by the Cowing Engineering Company, of Cleveland, and is of a type invented by John P. Cowing. The bridge is a double leaf bascule, but instead of the leaves turning about fixed trunnions the rear ends of the girders are made in the form of a circular arc and set in, and roll upon a nest of 29 ten-inch anti-friction rollers arranged in the form of a circular arc. The centre of gravity of the moving leaf is at the centre. As the bridge is opened the girder rolls on the nest of rollers and the centre of gravity of the moving leaf remains stationary.

The original structures over the Chicago River at Chicago were swing bridges. These are being gradually replaced by bascule bridges in order to free the channel of the centre piers. The more recent of these bridges have been designed by the Bridge Department of the city. All of them are of the fixed trunnion bascule type with the counterweight rigidly attached to the tail end of the trusses, and so located as to bring the centre of gravity of the moving parts at the centre of the trunnion.

The first bridge to be designed by the city of Chicago is the one at Clybourn Place. Each leaf is supported by three trusses, each of which is carried on a trunnion whose bearings rest upon longitudinal girders which span the counterweight pit. There is a pair of these girders for each truss and they are spaced just far enough apart to allow the tail

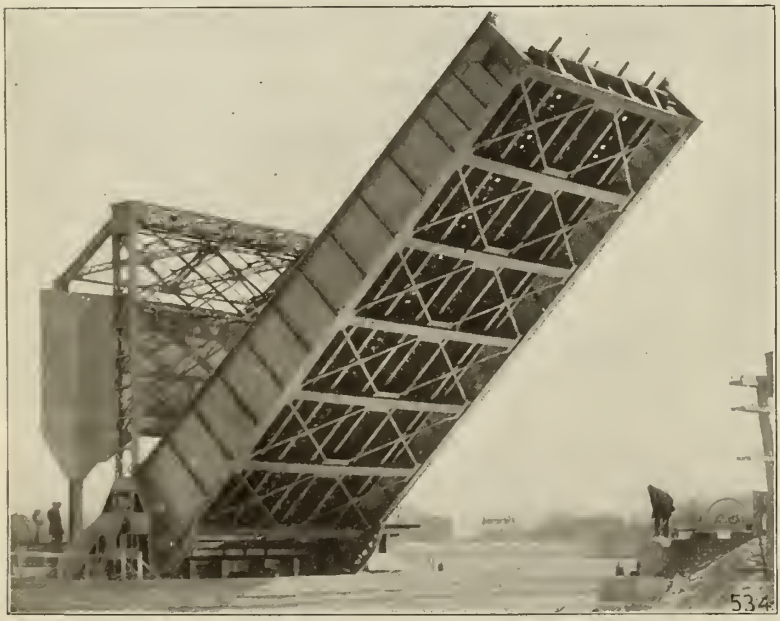


Fig. 13—Bascule bridge for B. & M. R. R., Manchester, N.H.

end of the truss to swing between them The span being comparatively short and there being three trusses for each leaf, sufficient counterweight is obtained by bolting cast iron blocks to the tail ends of the trusses. These blocks are so narrow that they pass between the girders which support the trunnion bearings. This design was prepared by Mr. Edward Wilman, city bridge engineer, and Mr. John Ericson, city engineer, with a view to its adoption for all bascule bridges over the Chicago River.

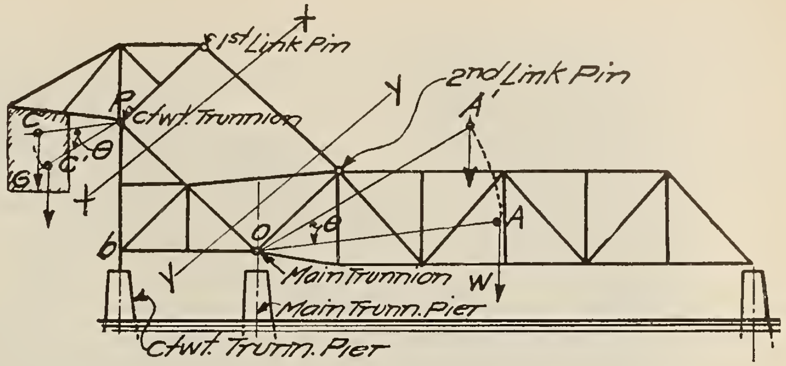
Some of the later bridges had the trunnions supported on inverted A-frames instead of girders. The back ends of these frames were high enough to allow the counterweight to extend from truss to truss, thus increasing the volume and decreasing the unit weight. The Kinzie street bridge is of this type. For both the Clybourn Place bridge and the Kinzie street bridge the live load on the moving leaf is carried on the bascule trusses acting as cantilevers. The main trunnions act as the front supports, and anchors in the masonry hold down the tail end.

A further development is noted in the bridge at Washington street, which has just been completed. Instead of there being a longitudinal girder on each side of the trusses to support the trunnion bearings, a longitudinal girder outside of each truss supports a cross girder which carries the trunnion bearings. This is partly shown in Fig. 10. The cross girder passes through the bascule truss, which is of such design that no web members interfere with the cross girders as the bridge is opened. The absence of the inside longitudinal girders permits of the use of a large counterweight volume and a low unit weight. There is a support in front of the main trunnion to take the live load when the bridge is closed.

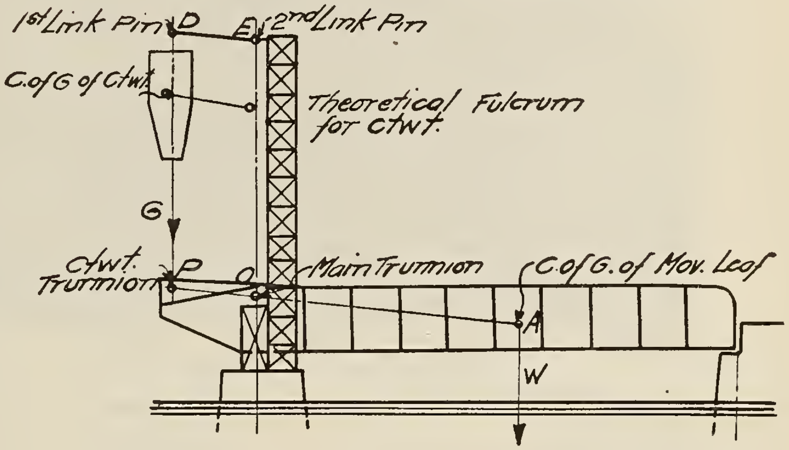
The new bridge at Jackson street, for which plans have been made, is to be of the same general type as the one at Washington street, except that it will be a deck bridge.

The bridge department of the city of Chicago has prepared plans for the proposed bridges at West Lake street and at Michigan boulevard. Both of these bridges are to be double-deck structures and both are designed as double leaf bascule bridges. In the method of handling the bridges and supporting the trunnions they are similar to the one at Washington street.

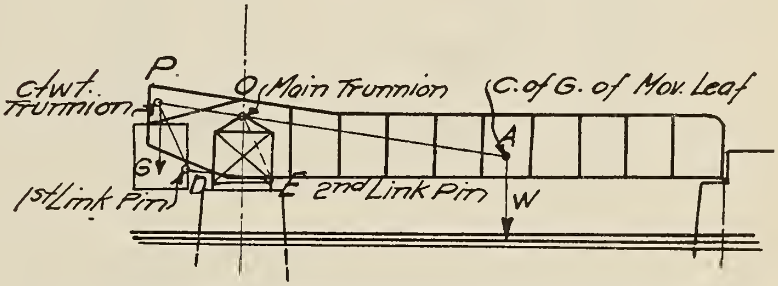
Other fixed trunnion bascule bridges with counterweight rigidly attached to the bascule trusses differ from the bridges just described in having the trunnions above the roadway instead of underneath. The counterweight is over the roadway when the bridge is closed. The False Creek bridge at Westminster



HEEL TRUNNION TYPE



SHORT SPAN - VERTICAL CTWT. TYPE



SHORT SPAN - UNDERNEATH CTWT. TYPE

Fig. 12—Types of Strauss bascule bridges.

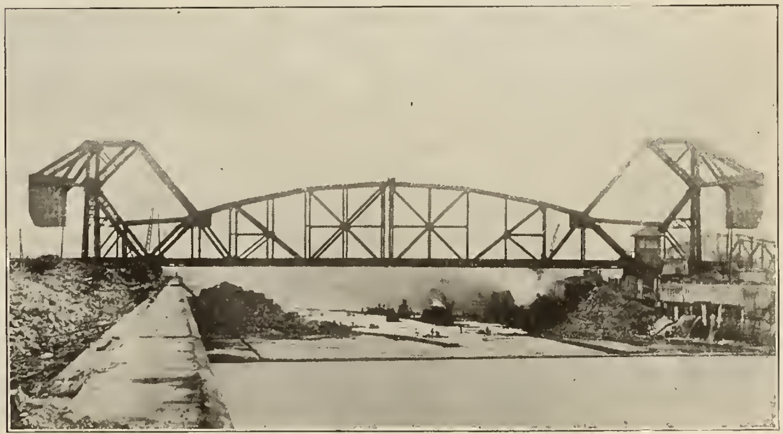


Fig. 14—Bascule bridge for C.P.R.R. at Sault Ste. Marie, Mich.

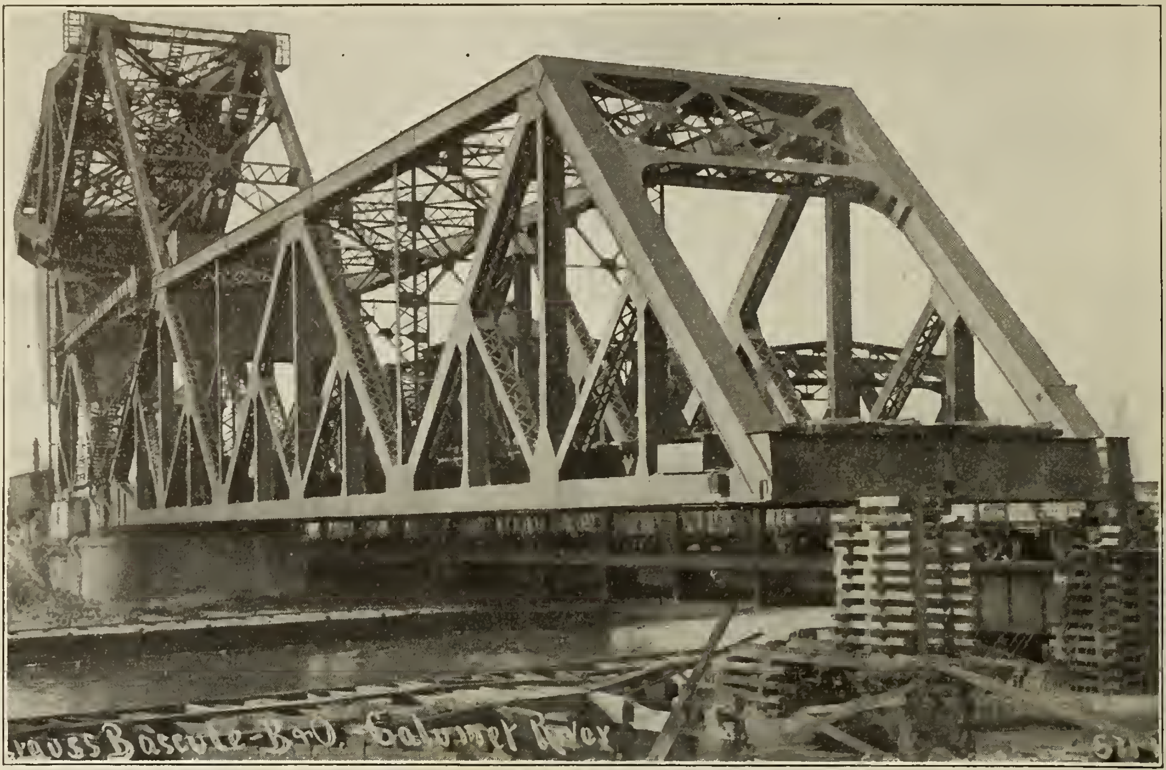


Fig. 15—Bascule bridge for B. & O. R. R. over the Calumet River at South Chicago.

avenue, Vancouver, B.C., is of this type, and was designed by Waddell and Harrington.

The crossing over the Oswego Canal at North Salina street, Syracuse, N.Y., presented unusual conditions. The street crosses the channel at an acute angle so that if the bridge, which is a single leaf bascule, had been placed with the bascule girder parallel to the centre line of the street the span would have been excessive for the required width of channel. In the design used the bascule girders were placed normal to the channel as shown in Fig. 11. A cross girder is framed across the front end of the two bascule girders and cantilevered out to carry the triangular section of the floor to the left. A similar girder extends to the right near the trunnion to carry a similar section of the floor. These cantilevered girders, however, carry only the dead load, as pedestals are provided to support them at various points when the bridge is closed. The bridge was designed by the Bridge Department of the State Engineer's office under Mr. Wm. R. Davis, chief bridge designer. It was opened to traffic in 1908.

Figure 12 is a schematic drawing showing the principles of the various types of what are known as Strauss bascule bridges. While there are many modifications of the Strauss bascule bridges, they all belong to some one of the three types shown and known as "heel trunnion," "overhead counterweight," and "underneath counterweight." For all three types the counterweight is connected to the moving leaf by means of a parallelogram whose sides are steel members hinged at the intersection point. The use of this

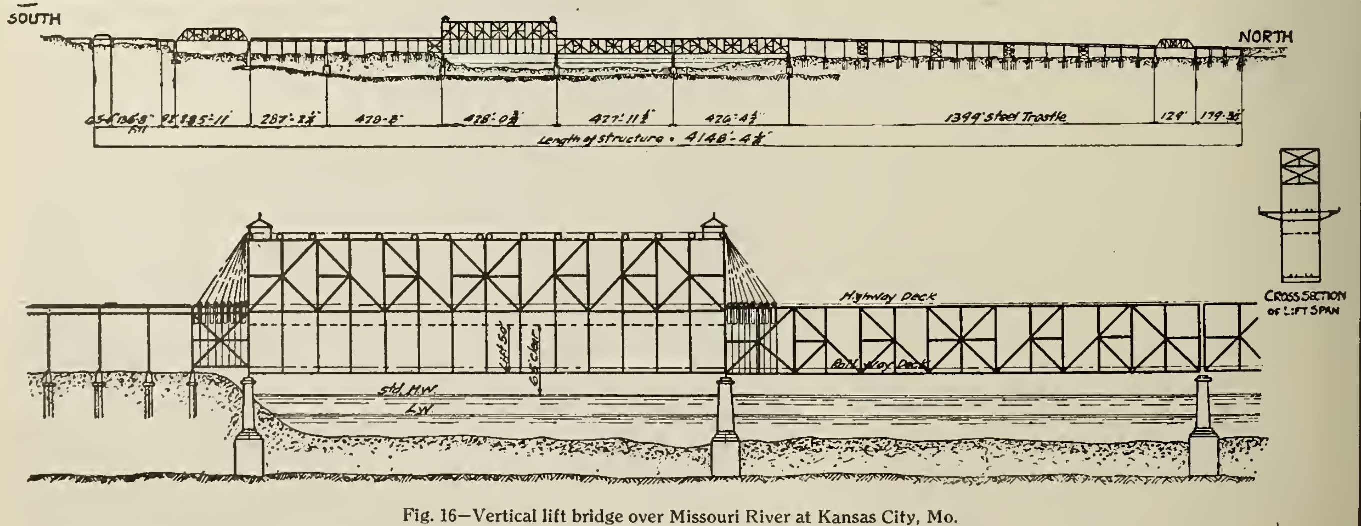


Fig. 16—Vertical lift bridge over Missouri River at Kansas City, Mo.

parallelogram eliminates the necessity of having the centre of gravity of the counterweight on a line through the centre of gravity of the moving leaf and the centre of the trunnion. This makes it possible to locate the counterweight where it will not interfere with traffic or other parts of the structure. All three of these types of bridges are balanced in all positions and, for all of them, the dead load pier reactions are always vertical and remain constant through the movement of the bridge. These bridges are designed by the Strauss Bascule Bridge Company, of Chicago. The first Strauss bridge to be built is the one which carries the Wheeling and Lake Erie R. R. over the Cuyahoga River at Cleveland, Ohio. It is of the overhead counterweight type. The moving leaf is hinged at the main trunnion at a point nearly in line with the bottom chord of the truss. The counterweight is supported on a steel frame pivoted to the tail end of the bascule truss at the lower end and pivoted to a link at the upper end. This link which is pivoted to the tower prevents the counterweight from tipping. The main trunnion and the counterweight trunnion are on a line passing through the centre of gravity of the moving leaf and when combined with the two link pins form a parallelogram. The inside trunnion bearing is supported on a cross girder which passes through the bascule truss whose members are so placed that the cross girder does not interfere with the truss as the bridge is opened. This bridge was opened for traffic October 14, 1905. A later form of the overhead counterweight type is shown in Fig. 13. This bridge was built for the Boston & Maine R. R. at Manchester. The counterweight frame is vertical and both the inside and outside trunnion bearings are carried on steel columns which rest directly upon the masonry. It was completed during the summer of 1911.

What is known as Knippel's Bridge, Copenhagen, Denmark, is of the overhead counterweight type. Large monumental towers which enclose the counterweights and provide operator's houses give the bridge a very pleasing appearance. The bridge has two leaves which when closed rest on pins so located as to enable them to act together as a three-hinge arch to carry the live load. This bridge was completed in 1909.

Fig. 14 shows the new Strauss double leaf heel trunnion bridge which carries the track of the Canadian Pacific Railway over the U. S. Ship Canal at Sault Ste. Marie, Mich. Each leaf is pivoted on a trunnion nearly in line with the lower chord. The counterweight is supported on a pair of trusses which are pivoted on the top of a tower. The front ends of the counterweight trusses are connected to the moving leaf by means of a pair of links pivoted at each end. The main trunnion, counterweight trunnion and the two link pins form a parallelogram. By having the centre of gravity of the counterweight on a line through the centre of the counterweight trunnion, parallel to a line through the centre of the main trunnion and the centre of gravity of the moving leaf, the bridge is balanced in all positions. This bridge is of special interest because of the fact that it is the only double leaf heel trunnion bridge which the Strauss Bascule Bridge Company have designed and because of the fact that, as far as the writer is aware, it is the only double leaf bridge which has ever been built for which a moment lock is provided at the centre. A compression and shear lock is provided at the centre of the top chord and a tension lock is provided at the centre of the bottom chord. These locks enable the section at the centre of the bridge to act together as a simple span to support the live load. The distance centre to centre of trunnions is 336 ft.

Figure 15 shows the Strauss heel trunnion bridge which is to carry the B. & O. R. R. over the Calumet River at South Chicago. It is a double track bridge and is claimed to be the longest single leaf bascule in the world. The length, centre to centre, of supports is 235 ft. The moving leaf is completed and was closed in the spring of 1913 but has not been put in service because other track changes are yet to be made.

Dr. J. A. L. Waddell has designed a number of the more recent vertical lift bridges. The first one built after his design is at South Halsted street, Chicago. Steel cables fastened to the four corners of the lift span pass over large wheels supported on towers at the ends of the span. Counterweights supported on these cables balance the lift span. While the bridge is moving it is held in place by guides on the tower. The lift span is 130 ft. long and has a vertical motion of 142 ft. 6 in., giving a clear head room when open of 155 ft.

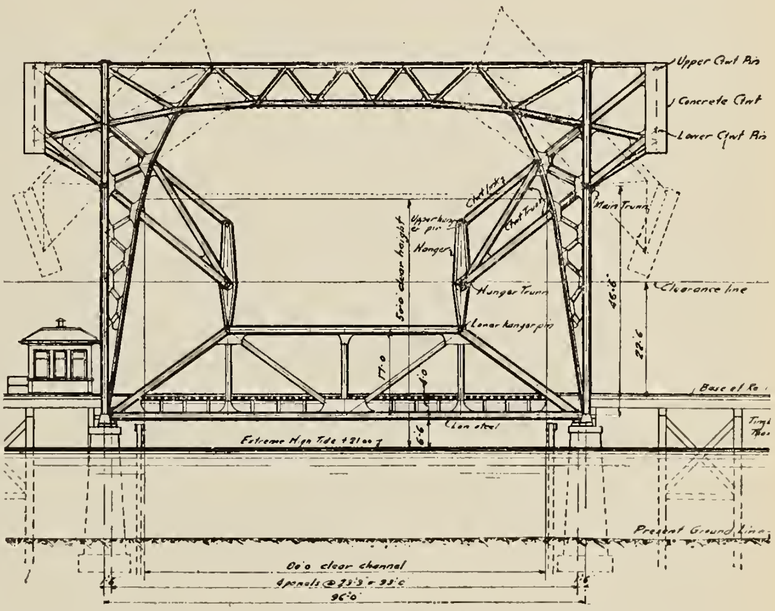


Fig. 17—Vertical lift bridge at Tacoma, Wash.

Figure 16 shows the vertical lift span of the bridge over the Missouri River at Kansas City. The structure, which is double deck, carries a railroad on the lower deck and a highway on the upper deck. The lower deck which is suspended from the upper deck by means of rods can be raised by telescoping the rods into the posts of the upper truss. The upper truss is fixed. The lower deck has a vertical movement of 50 ft., which gives a minimum clear head room of 65 ft. above standard high water. This bridge is of additional interest because of the length of span which is 428 ft., providing a clear channel of 413 ft., which is the widest provided by any movable bridge in the world. The double deck vertical lift bridge at Willamette River at Portland, Oregon, has a lower deck which can be raised by telescoping the suspension rods which support it, into the vertical posts of the upper deck so as to provide for the passage of ordinary boats. To provide for the passage of tall-masted vessels, after the lower deck has been raised until it comes nearly up to the upper deck, the two are lifted together so as to provide an underneath clearance of 140 ft. above high water. The two decks are counterbalanced independent of each other. Both of these bridges were designed by Waddell and Harrington, Consulting Engineers of Kansas City.

Figure 17 shows a type of vertical lift bridge which is of recent invention. Near each end the top chord of the lift span is hinged to the lower end of a hanger. A pivot near the centre of the hanger connects it to the end of a truss which is supported near the centre of its bottom chord by means of a trunnion carried on the top of a tower. A counterweight is pivoted to the opposite end of the truss. A pivoted link connects the top of the hanger and the top of the counterweight. As the lift span is raised the lower hanger pin moves in a vertical line and the hanger trunnion moves in a circle about the main trunnion as a centre. This inclines the hanger and since the hanger link, counterweight, and bottom chord of the counterweight truss form a parallelogram, the counterweight is inclined an equal amount. The weight of the lift span hanging from the lower end of the hanger tends to make it return to the vertical position. This tends to put compression in the link. At the same time the counterweight being inclined it tends to fall toward the channel and also tends to put compression in the link. By properly proportioning the weights and dimensions the action of the counterweight can be made to exactly balance the action of the weight of the moving leaf. For the bridge to be properly balanced, not only must the moment of the counterweight about the lower counterweight pin be equal and opposite to the moment of the moving leaf about the hanger trunnion but their moments about the main trunnion must also balance. To effect this latter balancing a second or auxiliary counterweight is provided which is rigidly attached to the counterweight truss just below the pivoted counterweight. The bridge shown in the figure was designed by the Strauss Bascule Bridge Company for the Northern Pacific R. R. over Steilacoom Creek at Tacoma, Washington.

No bridges of this type have been built, but a number of them have been contracted for during the last year and a half.

Figure 18 shows a type of vertical lift bridge developed by the Strobel Steel Construction Company. With this bridge the weight of the moving leaf is counterbalanced by a counterweight on the outer end of a truss which rocks over the top of a tower. For the bridge shown in the left of the figure, pivot C is supported on rollers which move back and forth as is necessary while the point B moves in a vertical line. For the bridge shown in the right of the figure the corresponding horizontal motion is provided by means of a roller at G.

A ten-foot concrete-lined steel pipe recently built in Baltimore to deliver water from the Loch Raven reservoir to the Loch Raven-Montebello tunnel at a point just below its gate house is described by Ezra B. Whitman, president of the Water Board, in the monthly journal of the Engineers' Club of Baltimore. It was estimated that this pipe could be constructed and that the relining of 1 mile of the old 12-ft. tunnel could be done for an estimated cost of about $300,000, as compared with the estimated cost of $480,000 for a new 12-ft. tunnel 6,340 ft. long joining the old tunnel 1 mile below its upper end. The pipe is made in alternate inside and outside telescoping lengths 15 ft. long and of 10-ft. minimum inside diameter. Changes in grade and alignment are made by beveling the ends of the section. The pipe is made of soft open-hearth rivet steel intended to have sufficient ductility to stretch rather than crack in case of unusual strain from water hammer or settlement. The metal is 7-16 in. thick, although a thickness of less than ¼ in. would theoretically suffice for the stress developed. The pipe is supported on concrete cradles intermediate between the riveted joints and having a radius slightly greater than that of the pipe surface.

A blueprinting machine that makes prints from 2 ins. to 48 ins. wide and of any length, and which occupies a floor space of 2½ ft. by 5 ft., has just been placed on the American market. The work, according to a note in the Engineering Record, can be carried out in a lighted room, as both the unprinted paper and the finished prints are kept in light-proof compartments. The tracings and paper are fed into the machine on an endless, automatically tightened belt operated by an electric motor. They then pass around the printing cylinder, which consists of spirally disposed bronze wires so arranged that the paper and tracings are kept perfectly smooth while passing around. Inside the cylinder is a mercury vapour lamp, which is said to be a very desirable source of light for blueprinting, as it is rich in chemical rays, with actinic powers particularly adapted for this work.

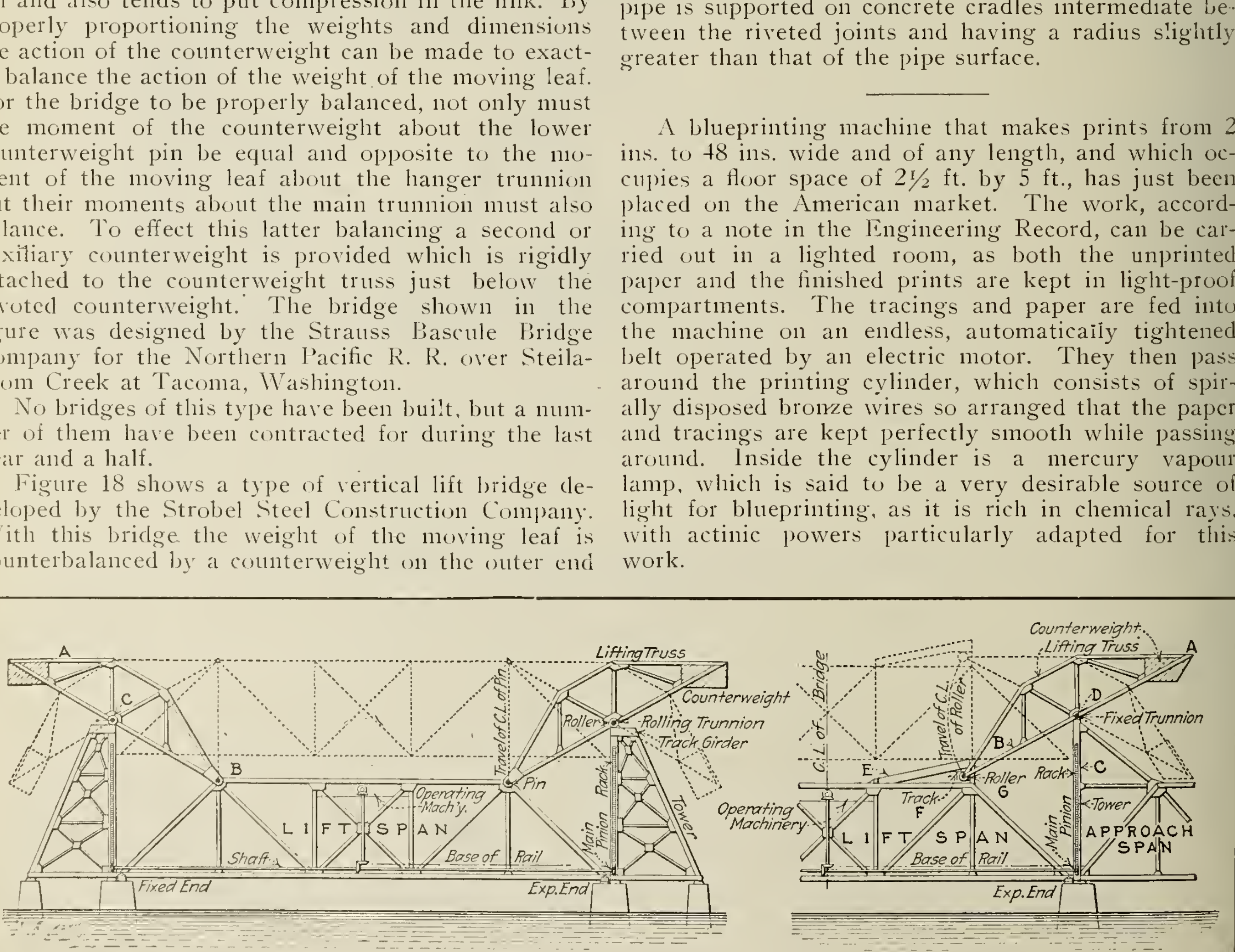


Fig. 18—Lift bridge at La Salle, Ill.

Conscience in Municipal Engineering*

Awakening Betokened by the Observance of a Code of Ethics—The Fundamental Requirements of the Civic Official

CONSCIENCE may be defined as an inherited tendency towards righteousness. It may remain dormant, but, fortunately, the majority of the individuals who constitute the "mass of humanity," possess this potential righteousness, and its awakening at some period during the career of the individual is probable.

The awakening of conscience is betokened by the assumption, the introduction and the subsequent practice, with more or less consistency, of a code of morals. This code is, however, practiced in two distinct manners. The majority are content to practice it conservatively and at home, avoiding carefully all temptation to violate it and succeeding admirably in adhering to well formulated principles without in the least disturbing the equanimity of their less moral neighbors and without, in any way, entering into the general conflict against the common evils which confront the race. Those of the other class, still in the minority, unfortunately, practice their codes openly, aggressively and with initiative. These are the leaders in the movements toward betterment in all walks of life and the achievements of a number of them whose activities are directed towards the public welfare, in what is commonly known as civic betterment, are of vast importance to the progress of civilization.

Coming to the point, we may take New York as the scene of the strife for civic betterment and may consider the municipal engineer in his attitude towards it. One does not have to delve into remote history to reveal this person in the guise of a moral tadpole. It is within the memory of living man, when he wiggled about in the pool of civic stagnation, hoping for the day when, as an active moral frog, he might jump to the bank and view the sunlight. The day has arrived and while the sunlight may, perhaps, at times, be obscured by a passing cloud, it is true that the tadpoles are developing hourly and are emerging in new form from the depths of the dark pool. Having seen the sunlight, it is the impulse of those whose lot has been cast in the pool, to go back and clarify it.

We are thus daily increasing the numbers of those who are aggressively following their code of morals. We are passing the time in which we were content to tolerate on the part of others what we considered improper for ourselves. We are unwilling to yield to those who will not see the sunlight and we are going to bring them into it or destroy them.

The latter day practice in municipal engineering has developed with some and has been forced upon others on the theory that each man must show his hand, he must work in the open, and the barrier of mystery in which the incompetent surrounded himself to conceal his incompetence, and with which the competent surrounded himself for protection against the incompetent, is destroyed. The "one-man policy" in which the person in a position of advantage acquires and holds information essential to the proper conduct of a piece of work, thereby making himself indispensable, is becoming obsolete. Engineers find that their positions are more secure and more important when they are understood than when their work is shrouded in mystery. It is no longer expedient to cover one's tracks in order to conceal possible errors. It is far more profitable to acknowledge and correct them. The executive engineer who exposes and reports his own mistakes as well as those of his subordinates gains the confidence of his superior officers and the respect of his subordinates. If his mistakes are too numerous to be tolerated, the old style concealment will not avail, for, as it has been said, the new idea is being forced upon those who do not adopt it voluntarily.

It frequently happens that specifications are incomplete, that some item of importance is omitted, or that some unexpected obstacle is encountered in the execution of the work which the contractor refuses to correct or overcome, without extra compensation. It has been known that such difficulties have been adjusted by an arrangement between the engineer and contractor, whereby the latter would be released from some less important obligation in compensation for his performance of the additional work. While these bargains were almost invariably made on the "dollar for dollar" basis and were usually of benefit to the work, it is within the scope of imagination to conceive of cases in which the bargain was made rather to conceal errors than to correct them. When, however, the work must be publicly reported in detail, or when the work is executed by an engineer who is beyond the control of the one who drew the specifications, the latter is required for his own protection to develop more carefully the details of his work so that corrections in the field will not be necessary.

Another abuse which has been abated by publicity is the ancient system of continuing work until the appropriation, far too large originally, became exhausted. It has happened that work has been extended and modified repeatedly until the ultimate creation was far in advance of the original and the funds still showed a balance. The process was similar to the plan pursued by the suburban homesteader who purchases a gallon of paint to cover the kitchen porch and finding a large balance on hand after having completed it, proceeds to paint the back fence and the barn doors. With specific appropriations based upon itemized estimates, carefully analyzed, there is no balance remaining after the completion of the work, and therefore its indefinite extension is not possible. Again the preparation of the specification and the estimate must be more careful for "extras" cannot be met within the appropriation.

There is another phase of municipal work which has undergone a change in recent years, and that is the relation between the executive engineer and his subordinate. The former is rapidly realizing that the errors of the latter will be revealed in the day to day "exposures." It is unprofitable to protect an incompetent subordinate for political or personal reasons, because the incompetence of the subordinate will be accredited to the superior who attempts to conceal or correct poor work.

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*By Alfred Williamson (Mechanical Engineer, Department of Water Supply, Gas and Electricity, New York City) in Municipal Engineering.

Ability is a comparative term and it fails to express all the qualifications which the latter day engineer must possess. Yesterday a man was judged alone on his ability and promptness. To-day he must be capable, prompt and efficient. We have a new dimension to consider, the unit of which is the dollar. In order to measure up to the new standard, a man must possess all three dimensions, the product of which is competence. The new idea then of competence includes ability, which is largely built on experience, it includes promptness which means energy, and it includes efficiency which means study. To be efficient one must recognize the errors made by himself and others and studiously avoid both. Someone has said that efficiency is common sense; it is more than common sense, it is insight.

The improved definition of competence, as set forth above, is to-day the test which every engineer must meet. He may possess one of the elements in larger measure than the other two, but he must possess some amount of all three and the executive engineer must possess even more than this newer competence; he must possess conscience, the active aggressive kind of conscience which influences other men. He must be one of the frogs already on the bank, one of the fellows who have seen the sunlight.

Again, he must possess courage, for conscience without courage is not a valuable asset. He must possess courage which will prompt him to go back into the pool and clean it. Taking then this alliterative trio, competence, conscience and courage as basic ingredients, we may mold a man of worth as an engineering executive.

The optimist believes that such men are already with us, men possessing the basic principles of leadership, and he believes there are a few who also occasionally reveal higher human attributes even than these, such as sympathy, fellowship and kindness, all of which are defined as consideration and all of which result, or at any rate develop from association with wholesome and cultured beings. As time advances, there will be more engineers, civic and private, who possess competence, conscience, courage and consideration.

A Contractor's Cost Account System

By C. E. Anderson

THE cost account system of an engineering and contracting company of Poughkeepsie, N.Y., is a good example of a concise method of keeping track of the cost of work under way. It enables the contractor to tell almost at a glance how much a particular job has cost him at a certain time, and also provides a permanent record to refer to at any future time as may be necessary.

The first step in the record of the job is the daily report made out by the foreman, superintendent or whoever is in charge of the work. A time book is kept, and from this the daily report is made out, showing location of job, contract number, date, classification of workmen, number of men of each classification working, number of hours worked, rate, amount, material used, to whom charged, material received, description of work. There are also columns opposite the time of the men, showing subnumbers.

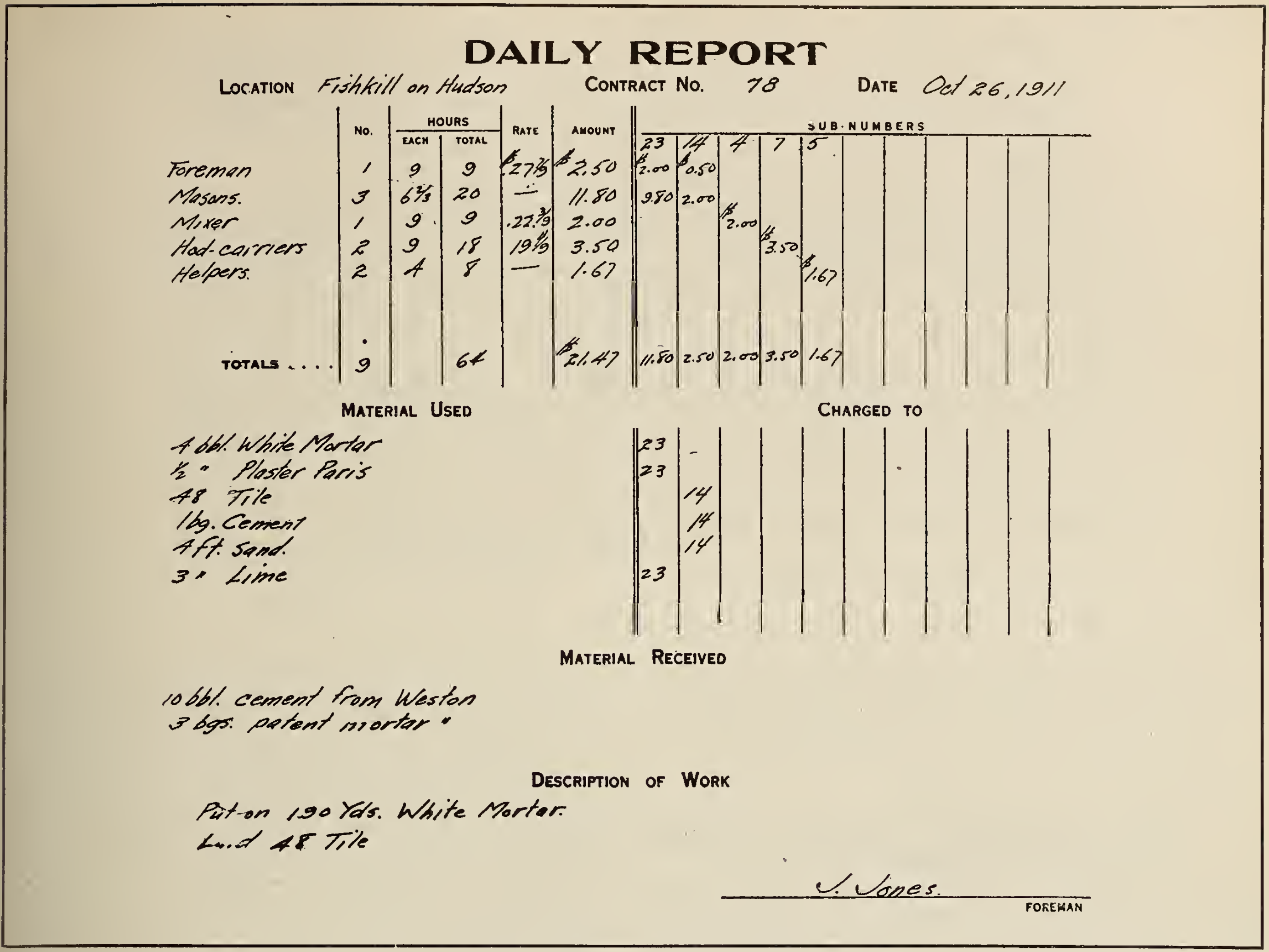
The subnumbers refer to the class or kind of work each man or group of men is doing. For instance, 1 denotes excavating, 1A rock excavation, 1B wet excavation, 2 foundation stone, 3 carrying water, 4 mixing mortar, 5 helpers, 6 hauling material, 7 carrying hod, 8 pointing walls, 9 laying brick, 10 working after plumber, 11 screening gravel, and so on, each operation having a number. By looking at the reports for the job it is evident at a glance just how many men worked each day, what was done by each man or group or class of men, how much they cost, how much material was used, whom or what charged to, and how much material was received.

When these reports are received in the office the data is tabulated. The reports for each job are placed on a letter file, which is hung in its place under its job number. In a journal is placed a daily record of material received, whom or what charged to, and cost. In the ledger are placed under job numbers and dated the total cost of labor, material used, cost and whom or what charged to, material received and whom or what charged to. On the opposite page is tabulated the credit, or material removed or not to be used on the job. At stated times the ledger is balanced and shows cost to date.

At intervals of a week, two weeks, or a month, depending on the size of the job, a balance sheet is filled out, showing the cost of each subnumber, or, in other words, the cost to date of each item of the estimate. Each item in the estimate, being represented by a subnumber, a form is prepared having a vertical column for subnumbers in the same order as shown in the original estimate. Across the page opposite these subnumbers are placed the daily cost of each subnumber or item. At the right-hand side of the page are two columns, one for the estimated cost of the subnumber and the other for the total cost of each subnumber to date. As each subnumber is completed its total cost shows up alongside of the estimated cost, showing immediately whether the cost of the item is smaller or greater than originally estimated. This system has been in successful operation for about three years.

In a small filing cabinet having twelve small drawers 4½ x 4½ x 10 inches, are kept copies of contracts, insurance policies, office help records, bills rendered, bills received, receipts and other papers which it is necessary to refer to from time to time in connection with the contracts. Each drawer is designated according to the contract number.

In letter file boxes are kept correspondence relating to contracts, filed under contract numbers. Bills and statements are filed in a separate box for each contract. On the outside of boxes containing correspondence is marked the dates between which the correspondence runs. Each box is labelled with the



DAILY REPORT

LOCATION Fishkill on Hudson CONTRACT No. 78 DATE Oct 26, 1911

	No.	HOURS EACH	HOURS TOTAL	RATE	AMOUNT	SUB-NUMBERS 23	14	4	7	5
Foreman	1	9	9	$.27 7/9	$2.50	$2.00	$0.50			
Masons.	3	6 2/3	20	—	11.80	9.80	2.00			
Mixer	1	9	9	.22 2/9	2.00			$2.00		
Hod-carriers	2	9	18	19 4/9	3.50				$3.50	
Helpers.	2	4	8	—	1.67					$1.67
TOTALS	9		64		$21.47	11.80	2.50	2.00	3.50	1.67

MATERIAL USED	CHARGED TO	
4 bbl. White Mortar	23	-
½ " Plaster Paris	23	
48 Tile		14
1 bg. Cement		14
4 ft. Sand.		14
3 " Lime	23	

MATERIAL RECEIVED

10 bbl. cement from Weston
3 bgs. patent mortar "

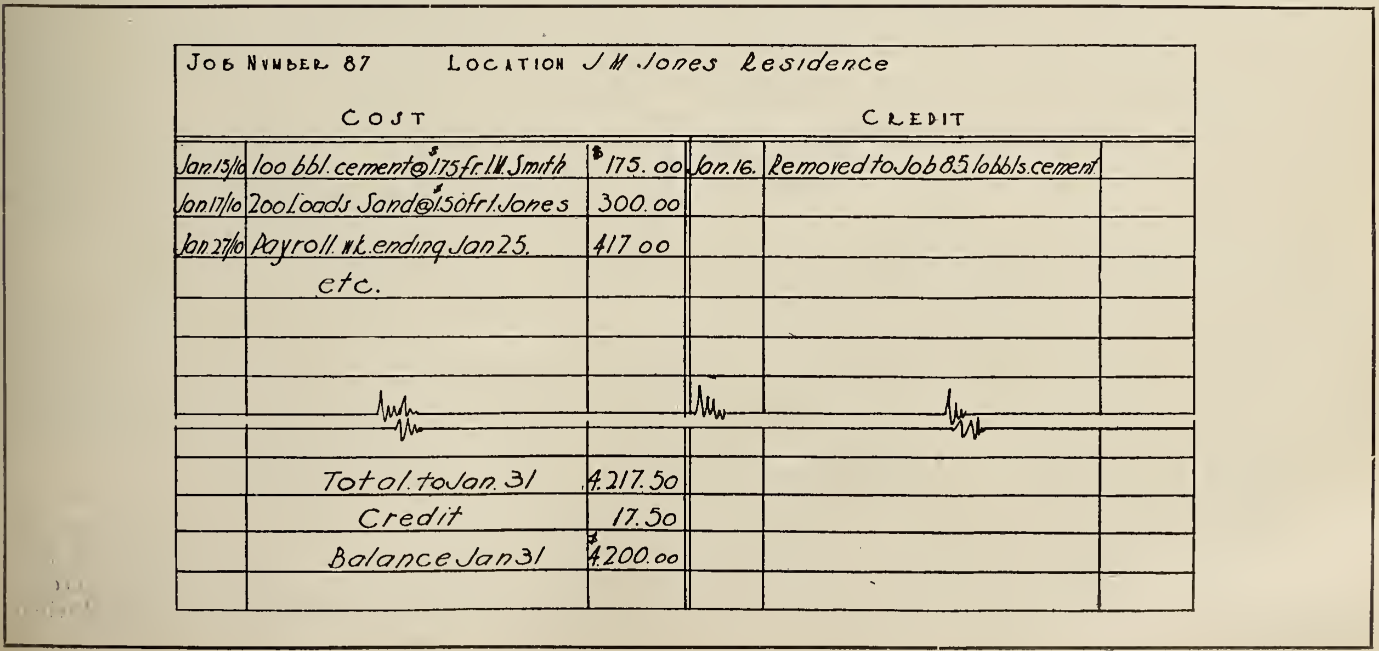
DESCRIPTION OF WORK

Put-on 130 Yds. White Mortar
Laid 48 Tile

J. Jones.
FOREMAN

number and name of the contract to which the matter in it refers. Boxes other than correspondence are labelled receipted bills, 'receipted bills previous to January 1, 1910, receipts, quotations, orders, bills due opened January 1, 1910, estimates. Each box contains an alphabetical file, between the pages of which can be placed at the proper letter the correspondence, bill, estimate, or whatever is to be filed at that letter. By looking at the backs of the boxes one finds the date, classification, or number of the manuscript for which he is looking, and in the box he finds it between the pages of the alphabetical index at the letter of filing.

By these methods all procedure is kept track of,



JOB NUMBER 87 LOCATION J M Jones Residence

COST			CREDIT		
Jan. 15/10	100 bbl. cement @ $1.75 fr. I.W. Smith	$175.00	Jan. 16.	Removed to Job 85. 10 bbls. cement	
Jan. 17/10	200 Loads Sand @ $1.50 fr. 1. Jones	300.00			
Jan. 27/10	Payroll. wk. ending Jan 25.	417 00			
	etc.				
	Total to Jan. 31	4217.50			
	Credit	17.50			
	Balance Jan 31	$4200.00			

Subnumber.	Jan. 1.19–	" 2.	" 3.	" 4.	" 5.	" 6.	" 7.	" 8.	" 9.	" 10.	" 11.	" 12.	" 13.	Cost to date.	Estimated. cost of total.
1.	2.00	5.00	3.00	7.00	1.00	4.00		7.00	2.00	11.00	3.00	5.00	3.00	38.00	40.00
2.	25.00	50.00	50.00	50.00	50.00	25.00								200.00	250.00
5.								5.00	7.00		1.00	4.00		13.00	10.00
7.															
21.															

Total Estimated Cost. $5000.00
" Actual. Cost $4500.00

all costs recorded and all other useful data preserved, so that by looking into the ledger or files it is possible at any time to tell what the job has cost to date, or what any previous job cost or any of its items.—The National Builder.

New Types of Country Road Surfaces and the Bad Weather Factor

FORMERLY, perhaps the most variable and troublesome element of risk in estimating the cost of building hard surfaced country roads was the difficulty of determining with any degree of accuracy the effect of weather conditions on lost time, says Engineering and Contracting, editorially. In building gravel and macadam roads the experienced contractor estimates no item more liberally than the item of lost time due to bad weather.

New types of pavements, however, which are coming into vogue are reducing the importance of this factor. Brick and concrete roads and bituminous surfaces on a concrete base are essentially rigid types of construction. When the base is in place construction may proceed with but little regard to the weather. Asphaltic concrete may be laid in comparatively damp weather. Brick surfacing may be laid under similar climatic conditions, provided the sand cushion is not placed too far in advance of brick laying. Ordinarily a damp subgrade is desirable in the construction of either concrete surfacing or concrete base.

Moreover, the percentage of labor cost to total cost has been materially reduced by the increased use of relatively more expensive materials. This condition undoubtedly leads to more accurate estimating, since the cost of materials is a much more stable factor than the factor of labor expense. The importance of the foregoing is self-evident.

The adaptability of the plant required for brick and concrete road building to other quite different uses and its consequent increased salvage value is worth considering. Road rollers and stone crushers are of use only in road construction. Concrete mixers, wagons and motor trucks are used for many other purposes.

There is no question but that more plant and more expensive plant is required in the construction of these higher types of surfaces. A careful analysis, however, will show that the ratio of plant expense to total is no greater on construction at $9,000 to $15,000 per mile than on construction that costs at the rate of $1,000 to $5,000 per mile. Moreover, the reduction in cheap labor expense which is generally effected by the use of machinery, permits the employment of a much more reliable class of labor, although the rate of wage may be higher.

Country and suburban road construction is rapidly becoming an inviting field for the large contractor. Equipment requirements for building relatively higher types of surfaces are beyond the credit and capital of the small contractor. And yet with this change the opportunities for the contractor of limited means to secure sub-contracts for grading or hauling are increasing and much work will undoubtedly be handled in this manner in the future.

These conditions are doubtless familiar to all engineers and contractors actively engaged in road building. But changes have come about so rapidly and are to-day taking place so fast that even the specialist in this work, strive as he may to keep posted by assiduous reading and observation, is apt to fall behind. Also a vast number of men engaged in other lines of work still cling to the accepted notions of ten years ago, although developments of recent years have materially changed old methods and types of construction.

The influence of the use of new materials on the old variable of lost time will be felt. The lost time factor is still important but instead of being almost entirely dependent on bad weather, other factors such as delayed shipments, breakdowns of machinery, and strikes must be considered, which factors formerly were of relatively small importance..

A clean, sharp, thoroughly dried silica sand or crushed quartz should be used for sand-blasting, and for use with a ¼-in. nozzle the sand should be screened through a No. 8 screen, and through a No. 12 when a ⅛-in. nozzle is used.

Practical Points in Modern Road Work

The Planning of New Routes—Improvement of Existing Roads — Tar and Tar-Painting — Repairs — Mechanical Haulage

By W. H. Maxwell, A. M. Inst. C. E.[†]

IN the planning of new routes, directness of line is usually an important feature to be considered, from an engineering and utilitarian point of view, but leads to monotony in the use of the road. As a general rule, it will be more advantageous to carry a new through route past the outskirts of a town, and connect up with some good branch road to the urban area, rather than attempt to carry the new main thoroughfare through the heart of a populated centre, as the difficulties and costs of widening existing narrow roads through built-up areas are necessarily excessive, owing to the property and business interests disturbed. Very wide roads are not favored by shopkeepers, as they are not conducive to good trade—the bulk of pedestrian traffic usually keeping to one side of such a road.

Curves on a new main road should, of course, be as easy as circumstances will permit, but a radius of 100 ft. should be the minimum where fast through traffic is to be accommodated. On this curve, a person travelling along the centre line of a clear 40-ft. roadway could see approaching traffic within the limits of the road-width about 120 ft. ahead. Under similar conditions, with a 150-ft. curve, a distance of about 150 ft. ahead could be seen. On rural roads, traffic invariably uses the centre of the road by preference, and modern high speeds render an ample, unobstructed view essential.

The easing of curves invariably quickens the speed and reduces that degree of commendable caution in drivers which formerly existed. On a sharp curve the motorist is bound materially to reduce his speed or perish.

Curves should in all cases be freed from side sight-blocking obstructions, and for increased safety to fast traffic the road surface on the outside curve should be given a suitable degree of super elevation.

Dead-level roads are to be avoided. If the longitudinal inclination is less than about 1 in 100, the surface water will be difficult to drain away, and more cross-camber must be provided. With a longitudinal gradient of 1 in 50, or sharper, the camber may be flattened considerably, as the needful surface drainage is obtained longitudinally. This flattening of cross-section should not, however, be carried too far, otherwise watercourses will speedily form down the centre of the roadway on steep gradients.

Suitable cambers for different surfaces under ordinary conditions are: Granite macadam, 1 in 25; tar-macadam, 1 in 30, or 1 in 40 on incline; creosoted deal paving, 1 in 36; hard wood and granite, 1 in 45; and asphalt paving, 1 in 50. The longitudinal fall of water channels should not be less than 1 in 100 for a granite channel, and 1 in 150 for asphalt.

Improvement of Existing Roads

Inadequate Foundations.—The majority of the old highways of this country have come into existence in a more or less haphazard fashion, and in the past the provision made for their maintenance has been uncertain and inadequate. The entire absence of foundations suitable for carrying modern weights brought upon the surface is revealed by the upward movement of the sides of the roadway into the channels—a weakness to be observed generally throughout the country.

Vast sums are now being spent in laying down expensive so-called waterproof surface crusts of various kinds, in order to give an immediate show for the money expended, but the writer is of opinion that wherever there is evidence of underlying weakness money may be more advantageously applied by first putting in proper foundations and drainage. However excellent, well laid or expensive may be the surfacing material, it can never prove really satisfactory on a weak foundation. There will be gradual but constant movement of the road crust, local sinkages of the central portion and rising of the sides, and generally the annual expense of wear and tear of the surface will be greatly enhanced in cases where no solid and unyielding foundation exists.

Thin Crusts.—The wisdom of recent practice in laying thin surface wearing crusts or armourings of asphalt and bituminous preparations over existing macadam surfaces is open to great question, except where an absolutely rigid and dry foundation can be relied upon. In the absence of this, most ordinary road surfaces are subjected to considerable movement under modern speeds and weights, and in these circumstances thin wearing crusts are liable to fracture and disintegrate. Great caution in the selection of a suitable site is necessary, except where laid on a good concrete foundation, which, unfortunately, in most cases, would make the cost of the work prohibitive.

Bituminous Methods.—In what are known under the general name of "bituminous methods" the presence of coal-tar and pitch is the distinguishing feature, and the main object of all such processes is to exclude water from the crust of the road. These methods consist mainly in the revival and extended use of tar-macadam, pitch-grouting, tar-binders, and other like forms, and in suitable situations and conditions give very serviceable surfaces at a not unreasonable cost, but much discrimination is needed in their application.

The arch enemy of the tar-macadam road is the traction engine, and this cumbersome, vexatious contrivance is, unfortunately, rather in evidence in the writer's district, especially during the spring and early summer months. These engines, with destructive diagonal steel strips on the wheels, weigh over 16 tons on the road, and haul three lumbering wagons weighing about 12 tons each when loaded. Under this burden the very best of tar-macadam work suffers substantial damage. Even after having been laid many months the material, owing to its plastic nature, will slightly soften on a hot day, sufficient to permit of its being crushed out of shape and torn up under traffic of the class named.

A well-made granite macadam road surface with-

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[*] Abstract of paper read at annual meeting of the Institution of Municipal and County Engineers at Cheltenham, Eng.

[†] Borough Engineer, Tunbridge Wells.

stands this class of traffic very much better than tar-macadam, or any of the bituminous processes.

To the enthusiast for tar-macadam, in addition to the above caution, the writer suggests that consideration of the following points will help to keep him out of trouble:—

(1) The quality of tar available for such work is very variable and unreliable, and requires constant watching to avoid failure.

(2) Good fine weather is an important factor for successful work. If the weather is too cold there is great risk of too much tar being used, thus causing the tar-macadam to become very soft and easily damaged during the warm weather.

(3) Tar-macadam is hopeless on a weak, yielding foundation.

(4) It cannot be satisfactorily repaired during wet, cold weather. This is important in streets where much opening of trenches for gas, water, electric and other services is likely to be required.

(5) Where there is much traffic a continual watch must be kept on the work for some time after it has been completed, which considerably adds to its cost.

(6) Tar-macadam is liable to "creep" during hot weather towards the sides of the roads, especially in country districts, where the lateral support of a kerb and footpath is not usually available, and some provision to meet this tendency should be made.

(7) The cost of tar-macadam is, as a rule, much beyond that of a granite macadam tar-painted surface, and its serviceable life cannot always be so accurately predicted.

The foregoing matters are mentioned, not with any desire to discourage the use of this type of road surface, but simply with the object of drawing attention to a few points which require consideration to ensure successful work.

With regard to the pitch-grouting of road macadam, the writer is of opinion that this process has not yet been proved to be so satisfactory under like conditions of traffic as good-class tar-macadam well laid. The work is expensive, its serviceable life is not great, the surface soon becomes deeply corrugated, and carries much slippery mud during wet weather.

Coatings of tar-macadam of a total thickness of 4½ ins. are sometimes laid with a layer of coarse material at the bottom, and finished with a fine grade for the surface. A coating of the thickness named is best laid in two layers, but there is no advantage in separating the fine and coarse grades; the same mixed grade material should be used for both coats.

Rolling of tar-macadam is best done with a light steam roller (6 or 7 tons weight), and there is nothing to be gained by an excessive amount of rolling.

Tar-macadam may be laid on gradients as steep as about 1 in 25, and even sharper if the surface is kept clean. The degree of slipperiness experienced depends greatly on the weather and the skill of the driver.

It is a great mistake to lay-tar-macadam or any other bituminous road surface over an existing macadam roadway as a foundation without first lightly scarifying the surface all over and consolidating by rolling to a uniform condition before the bituminous material is laid. Where this precaution has been neglected the old inequalities and potholes in the road crust will soon reappear on the surface of the newly laid coat, as the greater depth of bituminous material over the pothole consolidates mode than the thinner coating around.

Tar and Tar-painting.—Experience of recent years has led to the settling down of much preliminary clamour about dust-layers to the very general use of coal-tar. This new demand has brought about a very substantial increase in the price of tar, and, with the continued extension of bituminous methods of road construction, the demand appears likely to exceed the supply, and so set a limit on this form of road improvement unless competitive processes are adopted.

The specially prepared tar for road surface painting used by the writer weighs 12.95 lbs. per gallon, or 173 gallons to the ton. This is heavier than the weights recommended in the Road Board Specifications, but the tar is found to make very satisfactory work.

Tar-painting is not usually very successful on roads with damp, clayey subsoils, in shady situations, or under trees. A dry, sandy or chalky subsoil is the most favorable for the work, and in these areas operations can be started earlier in the season.

The heavy, complicated, costly tarring machines of early tar-painting days have almost disappeared in favour of much simpler plant and hand work, the latter giving the best results in this class of work.

For town work granite chippings ⅜-in. to ⅝-in. gauge make the best class of grit for covering the tar. Sand, though usually much cheaper, produces an increased quantity of mud and causes the tar-painting to tear up more readily under heavy traffic.

Increased attention is necessary on a tarred road to the picking up of horse-droppings and light litter, as these blow about much more readily than on an ordinary macadam road. The writer uses a number of light covered hand-barrows for this purpose on all tarred areas.

In his experience the amount of money spent on road tarring is about equivalent to the saving obtained in ordinary maintenance and wear and tear on the roadways, so that no increase on the total cost of highways arises, while a greatly improved surface is obtained during the summer and autumn months. Tar-painting gives most economical results on secondary roads, culs-de-sac, and other thoroughfares with light traffic, as, in some cases, the tarred surface remains in good condition for several years without repair, and very little attention of any kind is needed.

Repairs.—Systematic inspection of the roadways, and regular and prompt patching of depressions and potholes is very desirable, especially on motor-omnibus routes. For this work the writer uses a light roller of the convertible tractor type, which is well adapted for the purpose.

Under modern traffic conditions the highways require to be regularly patrolled and repaired, much in the same way as a railway track.

Old screened road metal of small gauge is well suited for patching, as it consolidates quickly.

Ordinary macadam surfaces should not be patched with tar-macadam, as, after a little wear, a most unsightly and intolerably bumpy surface results, owing to want of uniformity in wear of the variegated surface.

When recoating a roadway the thoroughfare should be closed wherever possible, and the whole width of road coated and rolled in one operation. Work of this class done in half widths is seldom satisfactory, as rapid wear invariably occurs at the central joint. In cases where this system cannot be avoided it is best, if possible, to first treat about two-thirds of the width, so as to keep the joint out of the centre of the road; but many roadways are too narrow to permit of this being done.

Weather conditions are among the most powerful factors influencing the wear and tear and deterioration of roads. Prolonged rain and heavy traffic following the break-up of frost immediately succeeding a wet period are particularly destructive.

In town streets where a macadam surface has to be renewed about every two years and patched frequently, a wood-paved surface will probably be more advantageous. A maintenance cost of 10d. per square yard per annum is about the economical limit for macadam, and, from the point of view of traffic weight, a load of some 250 tons per yard of width per day is about the maximum for an ordinary macadam surface.

Steam Rollers.—In the opinion of the writer the usual so-called "10-ton" steam roller is much too heavy for the majority of surface recoating work. These rollers, when loaded ready for the road, often weigh nearer 13 to 14 tons than 10, and frequently cause much damage to the new metalling by crushing and weakening it during the process of consolidation. In some cases metal is put on the hard crust of the old road without preliminary scarifying, and rolling down with a heavy steam roller, with the result that the stone, being severely crushed between hard surfaces, is permanently damaged at the outset, and the serviceable life of the new coat thus sadly reduced.

For much of this work the writer uses what is described by the makers as a 7-ton roller of the convertible roller-tractor type already referred to. This machine is found to be of the greatest service for all classes of work as well as for haulage. The small tractor roller can be moved quickly from job to job, and can be converted to a tractor in about a couple of hours. The cost of a first-class machine of this kind, including both roller and tractor gear, would be about £550. This roller, with awning, water, etc., fitted up ready for work on the roads, actually weighs 9.42 tons.

Mechanical Haulage for Municipal Work

Whatever may be the views held as to the desirability of public highway authorities employing steam, petrol, or other motor vehicles for haulage purposes, the writer has been practically compelled to do so on account of the difficulty experienced during the busy spring and summer seasons in procuring sufficient suitable horses. It is usually impracticable to keep, during the relatively quieter winter months, a full stud of horses sufficient to cope with all work during the busier period of the year, and such work as street watering and road tar-painting greatly accentuates the variation between winter and summer haulage demands. The hiring of the surplus summer requirements affords one way out where the horses can be got; but horse contractors are fast changing to mechanical haulage, thus greatly limiting the supply.

Slippery Road Surfaces

In these days of improved road surfaces, tar-painting, tar-macadam and such like, complaints are, perhaps, a little more frequent in respect of slipperiness, and requests for gritting or sanding are often made. The best plan to overcome slipperiness is to keep the surface as clean as possible by removing (and washing off, if necessary) stiff, pasty mud which is liable to accumulate during the foggy, damp weather of the winter months. Griting and sanding greatly increases the production of this stiff, slippery mud, as the material is speedily crushed by the traffic. The application of grit, therefore, should be done as sparingly as possible, and cleansing of the surface should take its place.

Collapse of a Port Arthur, Ont., Wharf

A section of a wharf belonging to the Canadian Northern Railway sank out of sight July 4 under a load of about 2,100 tons of steel rails. The "S. S. McKee" had completed unloading a cargo of rails in the afternoon and had left a short time before the accident occurred. The rails were 80-lb. A. S. C. E. rails, 33 ft. long, and had been placed in three piles, each pile being about 33 x 66 ft., with transverse spaces a few feet wide between piles. The section that failed was about 75 ft. square. Two piles of the rails were carried down with it, each pile containing about 1,050 tons. The entire length of the wharf was loaded with rails, some of the piles weighing 1,200 or more tons. The rails on the portion not wrecked were hastily loaded on cars to save from further loss and to facilitate the salvaging of lost rails.

The wharf, which was about 75 x 450 ft., was constructed in the winter of 1912 and 1913 by the Thunder Bay Harbor Improvement Company under the supervision of the Canadian Northern Railway according to plans and specifications furnished by the railroad. The pier was built similar to the others originally used for unloading steel rails and later was covered and used for package freight as occasion demanded. It is stated that some of these older wharves had supported piles of rails weighing as much as 1,400 tons without sign of failure.

The piles used were sound tamarack from 40 to 50 ft. long, with 12-in. butts, and were driven to hard bottom. The water varied from 12 to 20 ft. in depth. In places the bottom of the lake was covered with several feet of soft mud. No batter piles or sway bracing was used. The piles were spaced about 5 ft. each way and were capped with 12 x 12-in. fir running transversely. The longitudinal stringers were 6 x 10-in. fir spaced 24 in. on centres. The deck is about 8 ft. above the level of the lake. The portion of the wharf which remained standing supported several piles of rails, the edge of one being only a few inches from the rupture. The cause of the accident will probably not be known until after the removal of the wreckage so that the condition of the piling underneath can be investigated. If the rails were properly piled with a skid rail over each cap the piling would have been supporting about 11 tons each.—Engineering Record.

The cement gun is being used to finish the ornamental concrete poles which are being erected on Van Ness Avenue in San Francisco. The poles are for the double purpose of lighting and carrying trolley wires for the new municipal railway. The coating is being applied after the poles are erected, so that the finish will be free from the marks of handling, and the pole proper will seem to be monolithic with the base. After the surface has been sufficiently coated it is immediately trowelled to the desired lines, the aim being to secure a cement coating about 3-16-in. thick. The contract price for the finishing was $26 per pole.

The finish of a concrete surface should be determined before the concrete is placed and the work conducted so as to make possible the finish desired.

The Efficient Operation of Dynamite

Analysis of Action of Blast with Reference to Depth of Spacing of Holes and Amount of Powder for steam Shovel Work.

By Charles E. Anderson, Civil Engineer, New York City.

BLASTING for steam shovel work requires that the rock be shattered into pieces small enough to be handled by the dipper. At the same time the powder man must prevent the rock being thrown into the air to an unnecessary extent, a result calculated not only to do damage but to waste powder. It is true that economy of powder is not always the first consideration on a construction job, but the use of the proper amount of powder, in conjunction with the best depth and burden of the holes, will result in a saving not only in powder, but in drilling and shovelling.

Getting the full efficiency out of dynamite means not only using the least possible powder, but using it in such a way as to cut drilling and "dobe" shots to the minimum. Occurring frequently, as they do on some jobs, "dobes" or mudcaps have come to be considered a necessary evil; it is not every blasting foreman who is willing to admit that the large number of these shots necessary is due to some miscalculation in his blasting methods. These necessitate the stopping of work while the men get to a safe place and many such interruptions mean considerable loss on a big job. On the other hand, incorrect depth or spacing of holes means more drilling than is necessary, and a consequent increase in that item of expense. The following paragraphs are based upon actual work in blasting for the steam shovel, and an attempt is made by comparing shots and methods to analyze the results.

Holes sometimes miss fire even though the battery is in good shape and double caps are used in the holes. This may be due in some cases to leaving wire connections bare and stringing the wire along the ground. Especially if the ground is damp it will carry off a good part of the current where the bare wires touch it.

Holes for Steam Shovel Cut

On a certain piece of work, the layout of the cut was as shown in Fig. 2. The holes were spaced 6 ft. apart across the cut and 10 ft. apart, measuring from the face of the bench. The cut was a new location running close to and alongside of a main line tunnel, and it was necessary to use as light charges as possible. The rock was bluestone, very tough and rather seamy, a bad combination for blasting, especially on account of the proximity of the old tunnel. The depth of holes varied from 12 to 20 ft.

Regarding the spacing holes across the cut, while a wider spacing might have done as well, the width of the cut was such that three holes were not enough, and four worked in nicely. On the other hand, the close spacing of holes across the cut insured the thorough shattering of the rock between the holes within the limit of the force of the blast.

As to the spacing of the holes back from the face of the bench, results seemed to vary directly with the depths of the holes, so far as the apparent efficiency of the blasting was concerned. With 12-ft. holes, almost no dobeing was necessary. Where dobeing was necessary, it seems to have been on account of too light loading. As the depth of the holes increased without changing the spacing, the necessity of using mudcaps seemed likewise to increase. These results were due to some extent to the necessity of light loading. Wider spacing of the deep holes, with consequent heavier charges, would have remedied the trouble, and could have been used under ordinary circumstances.

Efficiency of Recorded Loading

A record was kept of the various shots, and shows that excessive mudcapping consistently followed the firing of deep holes with a light burden. Holes 1, 2, 3 and 4 in Fig. 2 were loaded respectively with 43, 15, 20, and 20 sticks of 40 per cent dynamite. Holes 5, 6, 7 and 8 were loaded with 55 sticks each, after having been sprung several times with up to 20 sticks with about 2 ft. of tamping. When finally loaded the holes were tamped full depth with clay. When these 12-ft. holes were fired the rock was lifted, shattered, and dropped back into place. Very little rock was lifted into the air, possibly because of the light loading of the front holes. It was necessary to fire one mudcap after this shot. This was probably due to the light loading.

Later, in the same arrangement of holes, the first four holes and two extras were drilled 12 ft. deep, and the second four, 20 ft. deep. The entire loading consumed 375 lbs. of dynamite. This shot was followed by seven dobes. At another time four 12-ft. holes loaded with 40 sticks each and two with 60 sticks each, were fired. No mud capping was necessary after this shot. Later a shot was fired consisting of three 20-ft. holes, two 12-ft. holes and five toe holes, consuming 375 lbs. of dynamite. Before the muck from this shot was cleared away 18 dobes had to be fired.

Close spacing of holes across the cut generally assures the shattering of the rock, while the longer spacing back from the face guards against blowing the rock forward too much. Having the proper burden in front of the hole means that the rock will be lifted, shattered, and dropped back into place. There will be very little scattering and flying of the rock. At the same time, the correct depth of the hole in relation to the burden insures that, with the proper charge, the rock will break all the way to the mouth of the hole and to the shoulder, and as a rule no big pieces will be left to dobe.

Analysis of 12-ft. Holes

An attempt is made in Fig. 3 to analyze and explain the action of a blast, and to discover why one depth of hole will prove more efficient than another. A 12-ft. hole is shown, "sprung" or chambered at the bottom, the charge being completely within the sprung or enlarged portion of the hole. The depth of the hole is shown from a to b, and the burden is indicated by the distance W. Dynamite acts equally in all directions. Let us indicate the horizontal force of the blast by the line cd. Since the force is the same in all directions, there is also a force equal to cd, acting against the solid rock in back of the hole. It is probable that about half of this force is reflected from the solid rock in the same direction as cd. This is represented in the diagram by the line bc.

These two forces, bc and cd, represent the total force of the blast, acting horizontally on the rock to be broken. Since the force is the same in all directions, there is, acting upward, a force ef, equal to cd, and a reflected force be, equal to bc. If we construct a parallelogram of forces on these, we get as a resultant the line bg, acting at an angle of 45 deg. There is, however, another force to be reckoned with. That is, the weight of the rock which is being broken. At first glance, this force would be said to work downward, and so far as the actual weight of the rock is concerned, it does. But from a point of view of efficiency, it works upward. This may seem contradictory, but my theory may be explained as follows:

The horizontal forces, after pushing the rock outward, have done their work and the rock is broken by the direct force of the blast. After pushing the rock outward the force is dissipated through the opened fissures. The forces acting upward, however, meet an added resistance in the weight of the rock against which they are acting. Instead of falling out of the way, as does the resistance to the horizontal forces, the resistance to the vertical forces is held in place and even increased by the force of gravity. Therefore, the unspent energy of the upward forces, instead of being dissipated, goes on doing work or breaking the rock opposed to it until it is expended, or until it has forced its way through the mass and freed itself. Thus the weight of the stone, instead of acting downward, acts, from a point of efficiency, as an aid to the force of the blast, inasmuch as it holds the rock against the force until the full strength of the blast has acted on the rock. This being the case, the added force, or more properly efficiency, due to the downward pressure of the rock, is indicated in an upward direction by the line fh.

Parallelogram of Forces

Since the weight of the rock could not exert a force greater than the resistance due to the solid rock back of the hole, assume that fh is equal to bc. Constructing a parallelogram upon bd and bh, we get a resultant bi. It will be noticed that the distance hi, or W, is ¾id, which agrees very well with the usual proportion used in practice for the depth of hole as compared to the burden W. If we accept this explanation of the forces as correct we should say that the 12-ft. holes used in this work were about right, or could have been a foot or so deeper, and the facts bear this out, since, when the proper charge was used, the rock was well broken with this depth of hole, and practically no mudcapping was needed after shooting 12-ft. holes.

Now let us consider the results obtained with the 20-ft. holes. It has been noted that with this depth a good many unshattered pieces were produced, which required mudcapping and consequent loss of time. The burden is indicated by the distance W, in Fig. 4. The depth of the hole is ab. In this case more dynamite is used; therefore the forces bc and cd, acting horizontally, are greater than in the former case, but are assumed to be in the same proportion. The same forces act upward, shown at be and ef. We also have the force fh, due to the weight of the rock pressing downward against the blast. As before, since the force fh cannot be greater than the resistance of the solid rock, assume it equal to bc.

Constructing a parallelogram on bd and bh, we

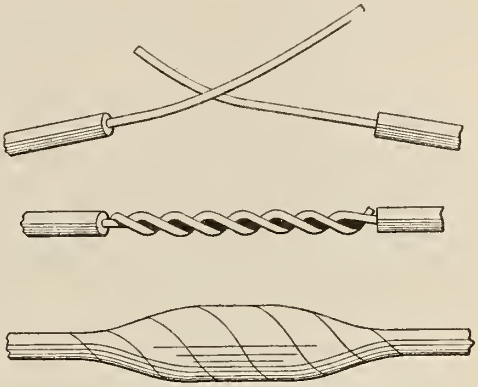
FIG. 1—CORRECT WIRE CONNECTIONS

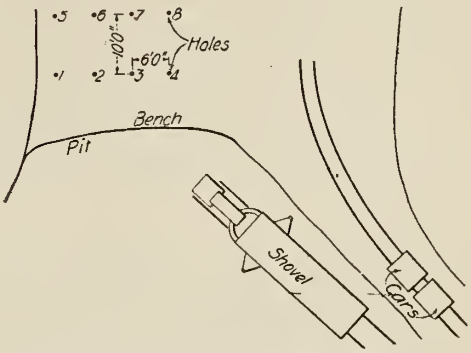

FIG. 2—PLAN OF STEAM-SHOVEL CUT

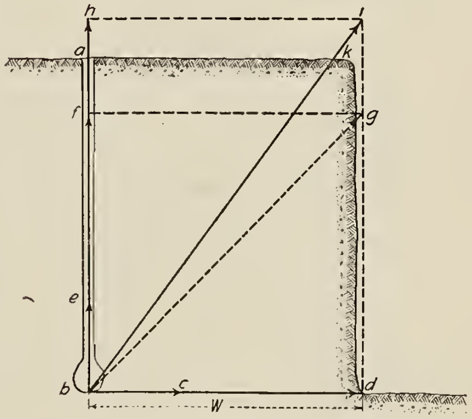

FIG. 3—12-FOOT HOLE

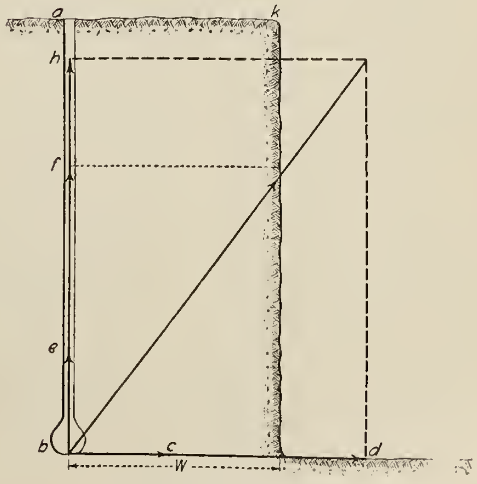

FIG. 4—20-FOOT HOLE

have as before a resultant acting in the direction bi. This dissipates itself at i, where it leaves the rock. Above this point there is the rock ikaf, which loses the effect of the strongest force, bi, the resultant of both horizontal and upward forces, and is broken merely because it cannot resist the expansion and cohesion of the shattered rock beneath it. This overhanging piece is not, to any extent, acted upon directly by the force of the blast. Some of it is broken because it is pulled apart by its cohesion to the shattered rock below it or falls because the support is blasted from under it. Not being directly subjected to the shattering force of the dynamite, it is not shatered but falls in big pieces which must be broken later by mudcapping.

Weight of Rock

Most writers on the subject of blasting speak of the "resistance due to the weight of the rock," treating it as simple resistance, in which case it would require more force in an upward direction than in a horizontal direction. If this were so we should have to drill our blast holes shorter than the burden, or distance W, in order to break the rock at the top of the holes. On the contrary, we almost always drill heavy blast holes deeper than W. Therefore within certain limits the weight brought about by the extra depth must be beneficial.

Authors in seeking for an explanation of the shattering forces at the mouth of the hole have mentioned the force of the escaping gases along the hole. This, it would seem, would not have a very great effect, becaues of the small area of the hole. On the other hand, if the confining influence of the rock is taken into consideration as above, and considered as beneficial within certain limits, it explains to a great extent the reason the rock breaks at the top of the hole as well as, or better than, that on the face of the bench. It must be remembered that the first fissure or crack opened to communicate with the atmosphere at the front lets out a certain proportion of the force acting in that direction, while the forces acting in an upward direction are confined by the weight of the rock until they have produced work to the full extent of their energy. As worked out herewith the best depth for a sprung hole should be about 4/3 W. This seems to agree with the practical examples given. In shorter holes where the weight of the rock would be small the conditions would of course be different, but the work described represents common practice in blasting for steam shovel work.

Most treatments of this subject consider the firing of a single hole and make the main point the computing of the charge. In general practice, the charge is best determined by trial. In general it might be said that the weight of the burden increases at the square of the burden W. There is another question which should be given attention, and which I believe would be of considerable interest to engineers, and that is a practical comparison of results obtained by different spacing of holes across the cut. As before mentioned, most writers on the subject of blasting neglect this point and are mainly theoretical.

While it is interesting to know how to calculate charges, they are not as a rule computed in the field but are mainly estimated from the experience of the man in charge. The proper depth of hole and the reasons therefor are not always clearly understood even by the experienced rock man, and I have tried to cover them in the light of practical results. On the other hand, I have not as yet had the opportunity to compare definitely the results of various spacings of holes across the cut under similar conditions, and would like to see the matter discussed by someone who has made observations in this line.—Engineering Record.

Inclined Conveyor Belts Handling Wet Concrete

In completing the upper part of the Lake Spaulding dam, built in Central California for the Pacific Gas & Electric Company, it was necessary to elevate the concrete above the mixing plant in order that it could be conveyed several hundred feet along the crest of the structure. Details are given by The Engineering Record. Instead of the usual hoist it was decided to install motor-driven, continuous belts for this purpose, and the 6-ply canvas belts with a ⅛-in. rubber coating which were used are reported to have given good satisfaction.

Beginning at the mixing plant, where four 1-yd. Smith mixers were employed, the concrete passed down a wooden chute which discharged onto a 28-in. belt moving at the rate of 420 ft. per minute and inclined upward at an angle of 20 deg. After being carried about 100 ft. on this belt, the concrete was discharged into a wooden flume, down which it flowed to discharge onto a second belt inclined upward at an angle of 18 deg. and operated at the same rate as the first. After this second lift the concrete could be chuted by gravity to the portions of the structure most remote from the mixing plant. Each belt was operated by a 20 h.p., 220-volt motor.

About 240 cu. yd. per hour were moved. The liquid portions of the mix did not separate and run back on the 20-deg. slope, it is reported, and it was found possible to clear the belt of its load at the upper pulley. A revolving wire brush was first installed to clear the belt just as it returned over the upper pulley, but it was later found more effective to replace this with a compressed air blast. The air was directed against the belt at 100 lb. pressure through 1/32-in. holes 1 in. apart in a ½-in. pipe.

When a piece of elevator machinery weighing 3,275 lbs. was being hoisted to the roof through the skylight of a two-storey portion of a bank building at El Paso, Tex., the rope carrying it snapped and the load dropped 85 feet. It fell upon a floor slab 5½ inches thick made of 1:2:4 concrete and provided with a main reinforcement of ½-in. square twisted bars spaced 6 inches o.c. and a temperature reinforcement of ⅜-in. square twisted bars, spaced 30 inches o.c. The result of this unexpected test was that a hole was made in the floor and that at a foot below the floor level the reinforcement held the piece of machinery. Practically no damage was done to the adjacent beam supporting the floor.

The water power resources of Canada are to be advertised at the Panama Exposition in San Francisco next year by a series of models of typical power plants from the Atlantic to the Pacific. These will be arranged in semi-circular form in the Canadian building, in front of a large painting presenting a bird's eye view of the whole Dominion. All known water powers, whether developed or undeveloped, will be depicted on this painting, which will be 75 ft. by 9 ft. Mr. Gibson Catlett, Toronto, has been entrusted with the execution of the painting.

Modern Methods of Preventing Explosions in Sewers*

WHEN a sewer is to be entered, or a lighted lamp or candle is to be lowered into it, great care should be exercised to avoid danger of explosion. Men accustomed to this work will quickly perceive the presence of illuminating gas or gasoline vapor, by the odor. This is the safest method of testing the air, but the observer should be careful to note whether the air is entering or emerging from the manhole, otherwise he is likely to mistake the absence of odor for the absence of gas in the sewer. If it is necessary to enter the manhole to determine the presence of gas, this should be done without a light, unless it be an electric lamp, and the man entering should wear a life belt with a line leading to his helpers at the top of the manhole. Although seldom done, it is always wise to open several manholes on the sewer to be entered some little time before the entrance is to be made, in order to provide a change of air within the sewer.

An inspection in, or very close to a manhole, should never be attempted by one man alone; the inspector should have at least one helper both for his protection and that of the public, and usually more than one. The helper should remain standing at the top of the manhole to warn approaching persons of the opening. Where the inspector is to go from manhole to manhole through the sewer a second helper should precede him to the manhole below that at which he enters. When the inspector has reached the second manhole, the second helper signals the first one at the first manhole, who replaces the lid and passes on to the third manhole, awaiting the arrival of the inspector at this point. Three men constitute the minimum safe size of gang for such inspection, and preferably two men should go together through the sewer.

Danger of Explosions

Many explosions have occurred in sewers, due to explosive mixtures of illuminating gas, naptha vapor and possibly other gases. Illuminating gas leaking from a defective gas main may find its way through the ground and into a sewer in sufficient quantity to cause an explosive mixture. Most sewer-maintenance superintendents have had experiences of this kind, although relatively few instances have resulted in explosions. It is not always easy to find the source of such gas, as it may travel a considerable distance from the point where it enters the sewer to the place where it is detected.

During recent years, trouble has frequently resulted from the discharge of gasoline into sewers, largely from automobile garages. Gasoline vapor is considerably heavier than air and therefore is not always readily distinguished by its odor when the observation is made from the top of the manhole. This new source of danger has necessitated ordinances preventing the discharge of gasoline into sewers and approving lighting appliances for the use of inspectors and laborers while working within the sewers.

An explosive mixture may result from the decomposition of the organic matter in the deposits. By such decomposition, marsh gas, or methane, may be produced in considerable quantities, and if there is not an adequate circulation of air to provide ventilation, it is conceivable that the proportion of this gas to the oxygen in the air in the sewer may be sufficient to provide an explosive mixture.

Other Sewer Dangers

Even though the danger of explosion is avoided, in exceptional cases gases may be present in sufficient quantities and of the proper kind to endanger the lives of the men working in the sewer. Illuminating gas, while most common, may usually be detected by its odor. If, however, there are some gas-works wastes in the sewage which impart odor to the air and yet are not dangerous, the men may gradually come upon a quantity of illuminating gas without noticing the difference in odor, and be overcome.

There is also danger from marsh gas formed in decomposing deposits and liberated in large quantities when these deposits are disturbed, as by being shovelled or walked upon. Hydrogen sulphide may also be formed under similar conditions, especially where the sewage contains sulphates, as from very hard water or sea water. An illustration of such conditions is furnished at the end of the Los Angeles Calif., outfall.

Another illustration is afforded by the death of three experienced sewer workmen at New Bedford, Mass., on April 10, 1914. A section of an intercepting sewer had been closed by a bulkhead in order that the portion below the bulkhead might be put in use while that above was being completed. The men entered the sewer at a manhole 500 ft. above the bulkhead. They adopted none of the precautions advised in this chapter. About 8 hours later, their bodies were found by a searching party under conditions which indicated that they had probably worked their way well down toward the bulkhead, when they discovered the presence of gas. One of them escaped to within 100 ft. of the manhole and then fell over with his face in a little trickle of water on the invert, in which he was probably drowned. The others did not get nearer than 300 ft. to the manhole; their bodies were found against the wall of the sewer, the arm of one through that of the other in a way indicating that he was helping the latter along when both collapsed.

The only practicable way in which to avoid danger of being overcome by such gases as may be found in sewers under exceptional circumstances appears to be to provide liberal ventilation before entering and while working in them. Care should also be exercised to provide young and vigorous men for such work, to see that there are sufficient men in the party to provide necessary assistance in case of need, and to require that life belts be used, when the men are in particular danger. For emergencies, the breathing apparatus used in mine-rescue work and for entering burning buildings may prove useful.

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* Reprinted from a forthcoming book on "Modern Sewerage Practice," by Leonard Metcalf and Harrison P. Eddy. McGraw-Hill Book Company, publishers.

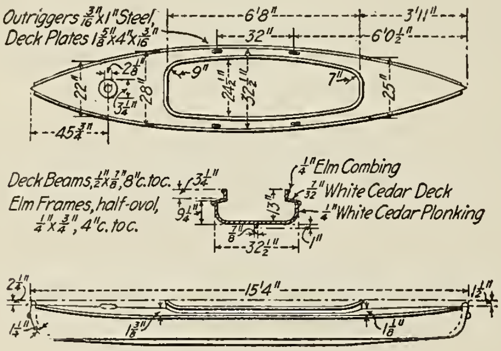
An Engineer's Canoe

Engineers engaged in reconnoitering work may find something of interest in the accompanying drawing, which is submitted by a reader of the Engineering Record. One or two men can sleep in this canoe comfortably by putting their feet in the ends and their heads toward the centre, using the sail for a boat tent, and mosquito netting or cloth at the ends. Thus nothing will get to them; even though they may roll a little in their sleep, snakes and other reptiles will not get nearer than the outside of the boat. This, as some who have been engaged on such work know from experience, is an important point. The writer continues:

"I prefer to have a pair of oars, a good paddle and a small rectangular sail that can be rigged as a spritsail by reefing a corner back, with good, substantial grommets at the corners and about 1 ft. apart on all edges, and about 6 x 8 ft.; when used as a tent the 8-ft. way is put fore and aft of the boat, and very small rope passed through some of the grommet holes and under the boat enables the sail as a tent to be drawn tight against the boat.

"A small box about 9 x 14 x 5 in. deep, outside measurements, is a great convenience and should be made with a hinged cover and lock. It forms a good seat for use in rowing and a convenient little place in which to lock up notebooks and small instruments.

"One man can easily carry this boat, if well made of good light cedar, over a moderate portage, as it only weighs about 75 lbs., or with the two oars, outriggers and rowlocks, a 5-ft. single paddle, stub mast and two spars with sail about 100 lbs., and yet the boat is strong and stiff enough to stand hauling over logs and bars and stony places. If well built of first-class materials, with smooth skin outside and all joints made up with white lead and oil or waterproof marine glue, and all copper rivetted with burrs, such a boat will cost with the fittings described from $75 to $100.



Details of Engineer's canoe

"In having one built care should be taken that the bilge planking is made to a proper cup shape at the turn of the bilge, as otherwise it is likely sooner or later to check on the outside and become leaky. The advantage in having the bilge as sharp as shown is its readiness to stand right side up and not rock or roll easily—an important point in any boat, and particularly in one as small and light as this, in which a man often entrusts his life in strange waters.

"I have travelled many miles in a boat like this with great comfort. I have been caught out on the Mississippi in summer squalls when neither bank could be seen and big steamboats have tied up, and have come through without danger. The boat rows easily and a man can make from twenty to fifty miles a day under oars in still water.

"Some points in the construction of the boat can perhaps be mentioned with advantage. One is the high combing, which somewhat stiffens the boat and deck, but is particularly advantageous in choppy water or when the boat is heavily loaded. Another point is the use of numerous small wide frames or ribs, which do not weigh much, but hold the planking together in a most satisfactory way, and being thin and near together, do not hurt an old man's bones when he lies on them with only a summer blanket under him."

The announcement is made that the course in architecture, leading to the degree of Bachelor of Architecture, at McGill University, has been increased from four to five years. Those who entered previous to the present year will be permitted to finish their course in four years' time, but students who enter in 1914 and thereafter will be required to take the full five years' course. The securing of a thorough education is stated by the University Corporation to be the reason for the change.

It is gratifying to note that despite the financial depression now prevalent throughout the world the mineral production in the Province of Quebec last year exceeded in value that of the previous year by nearly two million dollars. The 1913 figure was rather more than thirteen millions. Details are given in an interesting report prepared by the Superintendent of Mines.

An interesting building project is that of the Western Mausoleum Company, Winnipeg, who have obtained from the city of Calgary a cemetery site for the erection of a mausoleum with a capacity for 600 crypts. The building will be of reinforced concrete construction with stone facings. The crypts will be lined with marble.

A Diesel electric railway motor car has been receiving the attention of the railway authorities of Sweden. This car is driven by eletcric motors. The current is obtained from a generator mounted on the car and driven by a Diesel oil engine. Weighing about 70,000 lbs., the car has accommodation for fifty people, and has travelled over 2,000 miles of Swedish railways.

In selecting the permissible working stress to be allowed on concrete, the working stresses usually allowed for other materials of construction should be used as a guide, so that all structures of the same class, but composed of different materials, may have approximately the same degree of safety.

Foundation work is in progress on the office building which is to be erected at Dorchester Street West, Montreal, for the Liverpool, London & Globe Association. Messrs. Nobbs & Hyde, of Montreal, are the architects, and Messrs. E. G. M. Cape, Limited, Montreal, the general contractors. The building is estimated to cost $175,000.

Efficiency in the Waterproofing of Cement Surfaces

By G. H. Cresser

THIS problem is of great interest to the architect, engineer, building contractor and owner, as it is only recently that cement and concrete have been used extensively in the construction of the modern building. With all the advantages that cement has over other materials as to economy and strength, great care must be exercised in mixing and applying it to the finished surface, to get it uniform in color. It has been proved that hollow blocks absorb moisture 4 to 5 per cent. of their own weight and retain this moisture for some time. Damp walls, as we all know well, are a detriment to health, and this factor is appreciated to such an extent that it has actually retarded the use of concrete in some instances.

An argument against cement surfaces is that we do not get a uniform, pleasing color, but get varied shades of dull gray, very uninviting, that do not compare with the rich colors we find in terra cotta, granite, brick and decorated wood surfaces. There is no comparison, as cement surfaces, undecorated, give us a dreary, sometimes dirty, color that does not reflect the light, but absorbs it, and does not please the eye or appeal to the artistic temperament.

Desirable Qualities in Concrete

This little talk is not intended to condemn cement as a building material, but to advocate its use more than ever by improving upon what is done in that line to-day. If we can add to its strength, economy and fireproofing features a decorative rich color, and at the same operation make it moisture and strictly waterproof, we certainly will have a building material that cannot be duplicated the world over.

But, you will say, we have it now to a certain degree. Some makers of cement add color while making the cement. Some engineers and architects specify waterproof powder or liquid to be added to the cement while mixing. This has not been proved a success, as anything of that nature added to cement decreases its tensile strength to such an extent that it is almost unsafe. It also affects the metal used for reinforcements. You cannot get the added color on waterproofing compounds mixed uniformly, and still have your different shades, and this very often deteriorates the concrete body and leaves a bad surface for any kind of painting in the future.

Proper Way to Treat Cement Surfaces

The question now arises: "What is the proper way to treat cement surfaces so as to get them decorated and waterproof?" Washes, brushed on the finished surface of cement, made from waxes, gums, paraffin, etc., have been tried, but without complete success. It was now up to the paint manufacturer and painter to come to the rescue and make cement more popular and practical than ever as a material for building.

The paint maker and painter received very little encouragement from the engineer and cement maker when they first started on this problem, but finally, after years of experimenting upon all the different forms of concrete construction and under all conditions, and after a strenuous campaign of education and putting on sample jobs at enormous expense the "big ones" in the cement business and "big builders" began to sit up and take notice. They now look upon the paint makers and master painters as their best friends, as they have helped them out of many difficulties.

One Method That Was Unsatisfactory

The first method used with paint was to first give the cement a washing with zinc sulphate and finish over this wash with a white lead and linseed oil paint, but the paint does not hold up, and it is now conceded that linseed oil paint is a failure for cement surfaces, as the alkaline salts in the cement attack and disintegrate it.

The last and most successful method and material used to-day, and conceded by chemists, engineers and concrete men to properly decorate and waterproof cement, is a specially prepared paint, in several shades, to be brushed on by competent painters. The material contains no linseed oil or white lead and firmly adheres to the surface, filling small cracks and voids. Such a material is made by different manufacturers under various proprietary names, and requires two or three coats, which can be put on damp surfaces, but should be put on dry surfaces, and does not cover more than 200 square feet to the gallon, one coat. This material gives the dead flat finish of cement, and adds to the cost of your contract between 35 and 40 cents per square yard of surface painted. The smooth or rough surface of the cement finish has all to do with the cost of labor and material, as the stucco and rough cast surface requires more material and more brushing than the smooth trowelled surface.

Up to this point I have touched upon cement surfaces of the outside of buildings only. But we have inside walls and floors which must be decorated and made damp-proof, and floors must be made so the cement does not dust off.

Inside cement walls are either in the damp or dry class. Damp walls, especially where there is a water pressure, such as along rivers and walls that get soaked with water after heavy rains, are a problem and should, if possible, be coated on the inside and outside with a paint made from asphaltum products and decorated afterward with regular cement coating. Inside cement walls that appear dry are not such a difficult problem and can be treated the same as ordinary walls.

In connection with the damp class of walls I will say that there are on the market to-day several points recommended and made to apply on damp walls, but cannot say as to their success when used against water pressure.

Cement Floors

Another class of surfaces are cement floors. We all know that when put to heavy wear they soon show defects, get slippery or throw off dust, especially where rich in cement and trowelled to a granolithic surface. Giving the floor a cement wash will not answer for factories, shipping rooms or engine rooms.

The acids in the lubricating oils attack the cement and destroy its bond. The texture of cement floors and the finish vary so much that we cannot make the same specifications for all of them. They must be tested with specially prepared paint and put on by some one who has made a special study of dampproofing and decorating cement surfaces.

New Head Frame and Tipple Combine Unique Feature

THE use of reinforced concrete for the construction of coal handling plants is something of a new departure and offers several interesting engineering problems in design. A noteworthy instance of the successful application of concrete to a plant of this description is to be found at Morden, B.C., where the works of the Pacific Coal Mines, Limited, were recently equipped with a reinforced concrete tipple and head frame designed and erected under the supervision of Mr. V. C. Suckow, consulting engineer, Vancouver.

Concrete tipple and head frame, Pacific Coal Mines.

The head frame was built to accommodate two cages with a capacity of 12,000 lbs. each, and is seventy-six feet high from the top of the footings to the centre of the ten-foot sheaves. The frame was constructed with four main posts set vertically in the plane of the frame and with a batter of approximately one and one-half inches in one foot on the cross frame, and two back legs inclined at an angle of sixty-five degrees to the horizontal.

The loadings of the construction, while not in any way excessive, are of such a nature as to require very careful consideration. The jar and vibration caused by the high speed of the cables and the taking up of the slack, are of the utmost importance and for this reason the foundations were carried down sufficiently to give ample anchorage to the superstructure. It was also necessary to provide the most perfect mechanical bond possible between the reinforcement and the concrete, cold twisted steel being used throughout in all the members. All splices were made with laps in the steel of sufficient length to develop the full value of the bars and all beams and struts rods were provided with hooks on the ends to increase the tying or anchorage.

Owing to the vibration and varying intensity of the loads, it was found advisable to have as few members as possible through which the stresses were required to travel before reaching the foundations, and for this reason all the X-bracing commonly used in head frames of wood construction, were eliminated and the horizontal struts and beams were all provided with large gussets or bracket connections at the columns.

The vibration was largely eliminated from the structure by providing a heavy slab at the top of the frame to support the sheave bearings. This slab was made excessively thick with diaphragm connections to the columns. In this way most of the vibration was absorbed before it got into the main members of the structure.

The entire structure was calculated with a factor of safety of ten on both the concrete and steel, and ample allowances were made for wind and other stresses which might occur. One of the inclined legs of the frame was formed to provide a stairway to the sheave platform and had a gas pipe railing at the side, making access to the sheave bearings convenient and safe. The guides for the cages were bolted to cross timbers arranged between the horizontal struts and anchored to them with embedded bolts. The entire superstructure of the head frame required a little over one hundred yards of reinforced concrete.

The tipple offered no exceptional engineering features, the only point being a careful provision against the vibration caused by the Marcus screens, of which there were two. The hoppers or bins were all of the tank type of construction and suspended from the floor beams. An additional two inches of concrete over the required thickness was provided in the bottoms of all bins for a wearing surface. The tipple is designed to handle 1500 tons of coal every eight hours.

All the concrete used in the tipple and head frame was mixed one part of "Bamberton" cement to two parts sand and four parts of three-quarter inch gravel, the sand and gravel being obtained from a bank in the vicinity. All steel used for reinforcement was medium steel.

Cement Joints in Sewer Pipe

WITH reference to the above subject, which was discussed in an article by Mr. J. M. Begg, reproduced in the Contract Record of July 22, an interesting contribution is submitted to our contemporary, The Engineering News, by Mr. W. S. Lea, the Montreal consulting engineer, who writes:

> I have had some experience with cement-mortar joints made in three different ways: (1) where a gasket was not used; (2) where a gasket was inserted against the shoulder of the bell in the usual way; (3) where the gasket in the finished joint was at the entrance to the bell all the way round, calked flush with, or a little inside the outside edge of the bell. In all cases, the bottom third of the bell was lined with mortar before inserting the pipe. When no gasket was used, pipe 12 in. and over was centered by two small wooden chips. These chips were also used with the gasket in laying the larger sizes, 18 in. and over. Ordinarily, no difficulty was experienced in centering the 8-in. and 10-in. pipe without chips, whether a gasket was used or not. In every case the joints were pointed from the inside for all pipe 15 in. and over. In methods (1) and (2) the joints were protected with a burlap or cheesecloth band for pipe 18 in. and over.
>
> So far as my experience goes, I am of the opinion (1) that the lower part of the bell should be filled before the spigot of the succeeding pipe is entered, and with more mortar than is needed in that part of the joint; for safety the mortar should appear on the inside; (2) that it is im-

portant to use a gasket, not only to assist in centering the pipe, but I believe that the clogging, or slitting up of a gasket calked tightly into the bell, is a considerable factor in preventing leanage in either direction through the joint, where the cement mortar itself is defective; (3) that while no doubt it can be dispensed with, it is safer to use chips to prevent the larger pipes settling at the spigot end; (4) that while it is proper to give the joint a finished appearance by a moderate bevel, the so-called generous bevel is, if anything, worse than useless with the larger sizes, as it tends to sag away from the sides of the pipe; (5) that with the larger sizes, the joint should be supported by a strap of burlap, etc., unless a gasket is inserted at the face of the bell after the joint has been filled up the sides and over the crown.

Moreover, the third method of joint making has appeared to insure the tightest work so far as I have seen it used. This joint is made by lining the bottom third of the bell in the usual way, covering the gasket which is placed along the outside edge of the bell. The gasket is long enough to encircle the pipe, and the two end sections are brought out of the bell after passing clear of the mortar in the bottom. The spigot end of the pipe is then entered with its crown guided against the bell, worked down to center at both ends and bedded. After the joint has been completely filled with mortar, the free-end sections of the gasket are calked into the bell working from the bottom toward the crown. The gasket is driven flush with, or a little within, the face of the bell, the bevel applied, the joint pointed on the inside where accessible, and the surplus mortar cleaned out. There is not very much mortar driven through, particularly with the smaller pipe.

This feature of the mortar forcing through is occasionally objectionable in a way that is hard to avoid. The 12-in. pipe and under cannot be pointed from the inside, and if as sometimes happens, the plane of the spigot end is not perpendicular to the axis of the pipe, there may be a considerable space at the crown of the joint between the spigot end and the shoulder of the bell; and the mortar filling this space sometimes drops to the invert after the pipe laying has proceeded some distance in advance.

When laying 12-in. pipe, this feature has to be watched; it rarely happens with 8-in. pipe, or with the larger sizes where the joints have been pointed from the inside. With the joint made in this way the mortar is firmly held in the bell, and even if the bevel does sag, it cannot carry the mortar out of the bell with it.

I have not found the chips objectionable in the way Mr. Begg suggests; perhaps more mortar was placed in the bottom of the bell; at any rate the chips did not keep the pipe off the mortar; they were practically buried in it, near its upper edges. The chips were placed in this position so that they could be easily moved a little higher, or lower, when occasionally required; moreover, with the chips in this position, any inequalities in either the pipe or the chips do not raise or lower the spigot end so much as if the chips were placed lower down, opposite a diameter approaching the vertical. However, there is no doubt that with the chips omitted, the gasket will generally be fitted tighter in the bottom, and that is a desirable feature.

The consistency of the mortar is an important matter, and not at all easily controlled. The tendency is to have the mortar too soft, as it is easier for the pipe layer to handle. Unless quite stiff initially, the mortar which has been hurriedly mixed, becomes sloppy on further handling, and cannot be easily compacted or retained in the bell. The man who mixes the mortar often has too many other things to look after. The mortar should be mixed in very small batches, and kept thoroughly stirred some time before being used. This permits the mixture to absorb more water, and the proper consistency can be better gauged by the mortar man as further handling does not affect it; moreover, the mortar appears to be tougher, and works smoother.

Mr. Begg has adopted a good specification at Edmonton. Clause (e) which specifies that no joint is to be completed until at least two joints have been bedded and graded in advance is to be particularly recommended. In reading his well presented article, I had hoped to find the detailed description of the work extended to include the method or the procedure followed in bedding the pipe. It is in connection with this, that the most serious difficulties arise in laying sewer pipe. It requires considerable skill and patience to bed a pipe firmly, and at the same time have it lying true to grade and alignment. It is true that once the pipe is in the right position it can be held and supported by tamping proper filling around it with a thin-bladed tool. In this operation lies the greatest risk of lifting the spigot end slightly from the mortar in the bottom of the bell.

It has been the writer's practice to defer tamping immediately around the joint until after the mortar has set up; but in bright, hot weather, at least, the joints were covered with loose earth. Before back-filling the trench the following day, some of this filling was removed, before the tamping was completed. Possibly this was not a good system; care certainly had to be taken to maintain the compacted filling at the same level on both sides of the pipe, so as to avoid jarring it slightly off the line. It is surprising how easily this can be done with even a very light tamping iron.

LETTERS

Regina, August 1, 1914.

Editor Contract Record:

I read your Editorial on Depreciation (Contract Record, July 22) as applied to municipal officials, and I have no doubt that it will be appreciated to the full by the municipal engineering fraternity.

Whilst each official can, of course, make due provision for his own personal physical deterioration, his income is often inadequate to maintain his position and set aside the necessary allowance. Some municipal authorities provide a pension fund for their permanent staff, the funds for which are secured by contributions for the council and the staff.

The concluding remarks of your editorial as to the agitation which is taking place elsewhere for superannuation, should induce the officials to organize a similar movement in this country. At present there is no organization which can or will undertake this duty.

You will remember that last year I advocated the formation of a Canadian Institution of Municipal Engineers, and at the annual convention of the Canadian Public Health Association held in Regina last September, this question was discussed and a provisional committee was appointed to draft the Constitution. I may inform you that the matter has been under consideration, but owing to the time required for correspondence and consideration of the draft, progress has been slow. The Constitution is now nearly ready for publication and I hope to forward you a copy shortly.

If the municipal engineers agree to the formation of such an organization as is provided for in the draft constitution, they can then combine for their mutual professional advantage, for the improvement of their status in society and for a recognition of the need for superannuation—otherwise for personal physical depreciation, as you term it.

In any case, if the above proposition is not carried into effect, something else will be necessary to achieve the object you have in view, for no tangible progress can be made by individual and spasmodic efforts.

Yours truly,
R. O. Wynne-Roberts.

It is reported that negotiations have been opened between Canada and the United States regarding the construction of a canal, 12 ft. in depth, to connect Montreal with New York.

The National Paving Brick Manufacturers' Association meet at Buffalo at their eleventh annual convention, September 9-11. Details may be obtained on application to the Secretary, W. P. Blair, Brotherhood of Locomotive Engineers Building, Cleveland.

Operations are progressing on the erection of the new C. P. R. hotel at St. Andrews, N.B., estimated to cost $200,000. The architects are Messrs. Barott, Blackader & Webster, of Montreal, and the general contractors Messrs. Lyall Sons & Company, Montreal.

Personal Mention

Mr. W. B. Hunt has resigned the post of electrical engineer with the British Columbia Electric Railway Company. He will engage in private practice at Vancouver, B.C.

Mr. A. M. Nanton has been appointed vice-president of the Winnipeg Electric Railway Board in succession to the late Sir William Whyte, a former director of the Canadian Pacific Railway.

Mr. Jeremiah Gallagher, Waterworks Engineer of Quebec, died recently in Montreal. A native of Cork County, Ireland, he came to Canada in 1860. He was a Quebec and Dominion land surveyor and was a member of the Canadian Society of Civil Engineers.

Mr. Thos. Turnbull, who has spent four years with the C. P. R. and the Mason Bay Railway in Western Canada, has been appointed assistant chief engineer of the Canadian Northern Railway, with headquarters at Winnipeg. Some years ago Mr. Turnbull was connected with the C. N. R. in Ontario.

Mr. S. W. Coombe, who until recently was associated with Mr. D. H. Mapes, Superintendent of Construction during the erection of the Hotel Palliser for the Canadian Pacific Railway at Calgary, has been appointed Superintendent of Building Construction under the Dominion Parks Branch of the Department of the Interior. Mr. Coombe's offices are located at Banff, Alta.

Recent elections to membership of the American Water-Works Association include the following Canadians: Mr. R. A. Ross, consulting engineer, Montreal; Mr. R. C. Harris, Commissioner of Works, Toronto; Mr. Jas. T. Wickham, City Engineer's Office, eastern division, Montreal; Mr. Robert B. Owens, B.E., Government Buildings, Edmonton, and Mr. Jas. Barr, M.E., Department of Waterworks, Toronto.

Mr. Kenneth G. Rae has been awarded first prize in the competition for a design for the new city hall and police station, Westmount, P.Q. Eleven designs were sent in, the competition being confined to architects on the Island of Montreal. Mr. Rae receives a premium of $750 and the commission to carry out the work providing the plans are ac- Raine were judged to be of equal merit, and these firms were cepted. Other plans by Messrs. Brown and Vallance, Messrs. E. and W. S. Maxwell, and Messrs. D. H. Macfarlane and H. awarded $200 each.

Something About M. J. Haney, the Toronto Contractor

Michael John Haney is a name well known to the Canadian contracting community, for the man who owns it has been identified with some of the largest constructional enterprises in the country. He was born at Galway, Ireland, in 1854, was educated at Watertown, N.Y., and came to Canada in 1873. He first worked on a farm, but quite early in life he developed a great aptitude for railway construction, and he has carried out, with much skill and success, many important undertakings both in Canada and the United States. One of the earliest positions he held was that of Assistant Engineer on the construction of the Kingston and Pembroke Railway. He was Divisional Engineer on the Lake Ontario Shore Road in 1877, and became Superintendent of the Pembina Branch of the C. P. R. in 1879. Two years later he superintended the construction of Sections 14 and 15 of the C. P. R., known as the Cross Lake Section, which cost four million dollars. In 1882 he was Divisional Superintendent for the lines east of Winnipeg. When only twenty-eight years of age he went with the late Mr. Onderonk to British Columbia as Manager of Construction of three hundred and sixty miles of the C. P. R. With the late Hugh Ryan he undertook the construction of the Red River Valley line, from Winnipeg to West Lynn, now part of the Mackenzie & Mann system. From 1896 he was associated with Hugh and John Ryan in building the Sault Ste. Marie Canal, following which he became Manager of Construction Work for the C. P. R., for whom he superintended the construction of the Crow's Nest Pass line. For some years he was engaged on a number of important contracts for the Dominion Government. In 1909 he was the contractor for the intake tunnel for the Toronto City Waterworks. Mr. Haney was President of the Canada Cement Company in 1907. Of the many corporation offices he holds, it is sufficient in this article to say that he is President of the Point Anne Quarries and also of the Port Credit Brick Company. Aside from his purely commercial activities, his interests are comprehensive. He is on the Board of Governors of St. Michael's Hospital, Toronto, and is a Governor of the Catholic Church Extension Society of Canada. He is Honorary President of the Irish-Canadian Athletic Club, and in 1907 was President of the Toronto Improvement Society.

Mr. M. J. Haney, Toronto

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

At Guelph, Ont., a by-law has been submitted to the ratepayers on the question of the erection of a new collegiate institute in that city at an estimated cost of $125,000.

Tenders are about to be called for the $100,000 warehouse which is to be erected at Montreal by the Harbor Commissioners. The architect is Mr. F. W. Cowie, Montreal.

Prices on mill work and stone are being taken by the general contractors, Anglins, Limited, in connection with the new Loyola College to be erected at Notre Dame de Grace, Que., at an estimated cost of $400,000.

Messrs. Stewart & Witton are busily engaged in the preparation of plans for the hospital which is to be erected at Hamilton at an estimated cost of $200,000. The building will be three storeys high and provide accommodation for five hundred patients.

Nineteen hundred and fourteen is neck and neck with 1913 in the building permits issued at Montreal, where the figures for the first seven months of this year amount to $11,043,432, as compared with $11,497,950 for the corresponding period of last year.

The new building for the Liverpool, London & Globe Assurance Company, which is to be erected on Dorchester street, Montreal, at a cost of $175,000, is already well under way. Messrs. E. G. M. Cape & Company, Limited, Montreal, are the general contractors.

The Christian Brothers community has had plans prepared by Mr. J. P. Hynes, architect, Toronto, for the construction of a training college on their 115-acre property at Oak Ridges, Ont. The building, which is being designed to accommodate 120 students, is 180 ft. long. It is estimated to cost $200,000.

The Toronto board of control has recommended to the city council the passing of a by-law to provide an additional $8,000 for the construction of the Crawford street bridge. The contract was let for $40,669 exclusive of paving, which latter will cost about $2,500. The original estimate was $38,650.

A step towards securing stability in the building trades at Montreal has been taken by the General Contractors' Association regarding the stonemasons' demands. An offer is reported to have been made by the masters offering the men a wage of 50 cents this year and 55 cents next year, with a nine-hour day in summer and an eight-hour day in winter. The proposal has been taken into consideration by the men.

Mr. M. J. Butler, Montreal, Que., has been chosen by the city of Montreal as valuation expert to make an examination of the plant of the Montreal Water & Power Company, a private company which owns the waterworks in the small towns and cities surrounding Montreal. These towns are now a part of Greater Montreal, and Mr. Butler will make this examination with a view to the purchase by the city of all these plants. Mr. Butler is a consulting engineer in general practice in Montreal, and is a director of Armstrong, Whitworth & Company, Limited, of London. He is a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Institution of Civil Engineers, and president of the Canadian Society of Civil Engineers.

The dredge Leconfield, which sank in thirty-seven feet of water last December, while digging in the channel entrance to Courtenay Bay, has been successfully raised by Mr. E. O. Leahey, contractor, of St. John, N.B. The dimensions of the dredge are: length, 135 ft.; beam, 35 ft., and depth 6 ft. The dredge was brought from Rotterdam by the Norton Griffiths Company to assist them in their harbor development contract work at East St. John.

The report for 1913 of the Superintendent of Mines of the Province of Quebec to the Hon. Honore Mercier, Minister of Colonization, Mines and Fisheries, states that despite the general financial depression which prevails throughout the world, the mineral production of the province of Quebec for 1913, which amounted to $13,119,811, exceeds the previous year's by nearly two million dollars. As in the past, the production of asbestos heads the list, the shipments having reached a value of $3,830,504. The province of Quebec supplies 80 per cent. of the world's production of asbestos.

The new office building of the Quebec Harbor Commissioners, which opened last week, is a handsome structure designed after the classic Rennaisance style of architecture. It is built of Deschambault limestone, while the roof and clock tower are covered in copper. The structure is fireproof, consisting of solid masonry walls, steel columns and beams cast in concrete, reinforced terra cotta floors, terra cotta partitions and wall lining. The vestibule and corridors on the three main floors are lined to a height of seven feet with marble. The building was erected from plans prepared under the supervision of Mr. Thos. Reid Peacock.

St. John, N.B., Progress

The Salvation Army Metropole, which was burned last winter, will be replaced by another building, which will be erected on St. James street, a few blocks from the site of the former structure. The Evangeline Home will be used for this purpose with the addition of a brick wing. The citizens of St. John have already contributed $20,000 to the building fund.

While St. John has made rapid progress as a city, both along industrial and other lines, the necessity for cheaper power is becoming more and more apparent. It is expected that this necessity will be met before long by a contract with either one or other of the hydro-electric companies whose projects are before the public. The New Brunswick Hydro-Electric Company, represented by a New York financial firm, have offered the city council special rates (covering both power and light), which have been approved by the city commissioners.

The municipal council of St. John has asked for tenders for the construction of a tuberculosis hospital of brick construction.

The Union of New Brunswick Municipalities will meet at St. John on September 9-10. All the municipalities of the province will send delegates to the meeting.

Within the next few weeks the new refinery plant of the Atlantic Sugar Refineries, Limited, which is regarded as one of the finest in the Dominion, will be in operation. Construction work began in January, 1913, the contractors being E. G. M. Cape & Company, Limited, and the Dominion Bridge Company. The building, nine storeys in height, covers a ground area of seven acres, with a floor space of 175,000 square feet. The motive power is electricity, generated by a steam plant on the premises. The extent of production will be 1,000,000 lbs. per day. The company will manufacture its own barrels. The capital stock is $10,000,000, of which $6,000,000 has been issued.

The process of deepening the oil wells near Moncton, 88 miles from St. John, has been going on lately with satisfactory results. Well 36, deepened to 1,670 feet, is yielding 2,000,000 cubic feet of gas daily. A similar increase is shown in well 35, which has been sunk to a depth of 1,700 feet. If the other wells show like increases upon further boring it will greatly enhance the value of New Brunswick oil prospects.

WESTERN CANADA

The Regina utilities committee is considering the advisability of adding one storey to the offices of the Municipal Street Railway.

It is expected that the building figures at Regina for the month of July will exceed those for the corresponding period of last year by about $100,000.

At Victoria, B.C., work is in progress on additions and alterations to the post office building estimated to cost $150,000. Messrs. McAlpine, Robertson Construction Company are the general contractors.

Contracts for the construction of the storm and domestic sewers at Regina have been awarded to E. G. McVean and the R. J. Lecky Company; the former getting contracts aggregating $26,355.71, and the latter $50,068.40.

Constructional work on the new Grand Trunk Pacific Railway twelve-storey hotel at Regina, Sask., is being rushed as rapidly as possible, over 75 men being employed on this work at the present time. The steel work is well under way.

At Edmonton plans have been prepared by Mr. E. W. Morehouse, architect, for a four-storey office building for Mr. Hugh McFee, estimated to cost $100,000. The building will be four storeys high, of stone, brick and steel construction.

Messrs. Hodgson, King & McPhalen Bros., of Vancouver, B.C., have secured the contract for trunk sewers to be laid in Vancouver to the value of $309,052. Mr. Geo. W. Phipps is the engineer of the work, which is in connection with the Vancouver and Districts Joint Sewerage and Drainage Board scheme.

Excavating is in progress for the new police station which is to be erected at Regina at a cost of nearly $150,000. The building is to be four storeys high, of stone, brick and reinforced concrete construction. Messrs. Clemesha & Portnall are the architects and Messrs. Frid, Lewis & Company the general contractors—both Regina firms.

Contracts representing an expenditure of $51,882 for street lighting and generating equipment at the new Regina power house have been approved by the city council. The largest item on the list is the sum of $32,000, which will go to the Westinghouse Company for a large switchboard consisting of 26 panels of blue Vermont marble, sufficient to control a 15,000 kw. plant. Other contracts awarded are as follows:—The Canadian General Electric Company, $8,570; the Northern Electric Company, $268; the Malone Electric Company, $594; the Siemens Company of Canada, $7,850, and the Burnham Engineering Company, $26,000.

It is expected that the Alaska railway, which the United States Government is building to the extent of 1,000 miles, at a cost of $35,000,000, will be followed by an extension of the line from the Yukon into Northern and Central British Columbia, connecting with the main line of the Grand Trunk Pacific Railway. Preliminary surveys are almost completed and Lt.-Col. Arthur Mears, who has been appointed Superintendent of Construction, is arranging for the commencement of the undertaking.

The Estevan Clay & Pottery Company has been granted its charter of incorporation. The pottery is to be erected about one and one-half miles west of Estevan, Sask., at an approximate cost of $100,000. Samples of pottery produced from clay blends obtained in that locality are said to be of particularly fine quality and capable of excellent finishes. It is anticipated that when the plant is in full swing about three hundred hands will be employed. The provisional directors of the company are A. Bernstein, T. A. Condie, W. J. Perkins, F. T. Taylor and H. A. Cameron.

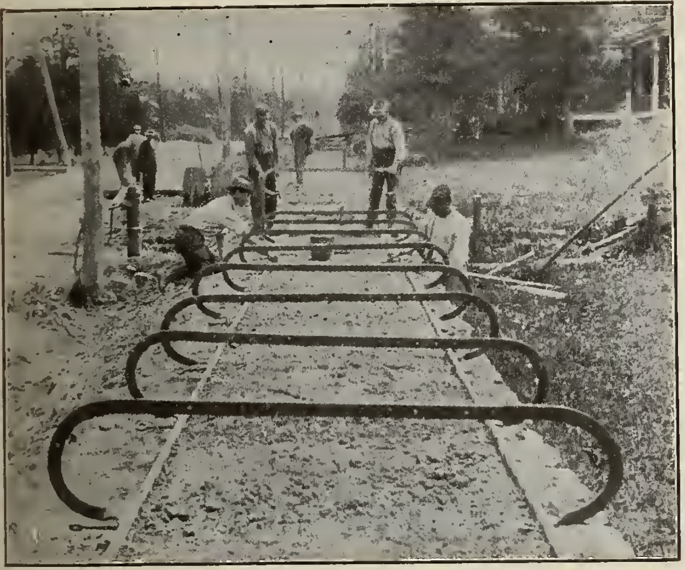
The Dominion Shipbuilding & Drydock Company, Limited, Vancouver, are carrying out a gigantic scheme for the extension of their plant at Lynn Creek. Tenders have been called and will be received until September 1st for a shipbuilding plant, the estimated cost of which is $5,000,000 while bids for the supply of machinery are invited until October 1st. The site comprises 140 acres, on which machine shops will first be built. This will be followed by the construction of two marine railway buildings and two concrete wharfs. The time allowed for the completion of the plant is two and a half years.

A bridge to cost over $400,000 is proposed at Victoria, B.C., to connect the business part of the city with the old Songhees Indian Reserve. About two years ago the Government of British Columbia acquired the reserve, which is situated on the west side of Victoria Harbor, and laid out the land for railroad terminals and industrial sites. The Canadian Northern Railway and the Esquimalt & Nanaimo Railway, which is part of the C. P. R. system, propose to erect a large passenger terminal. Both railways will also have their freight yards on this land. To connect the business part of the city with the reserve it is necessary to construct a bridge across the harbor. The type of bridge has not yet been decided, but it will either be a bascule or swing span. If a bascule, the clear opening between fenders will be 130 ft. If a draw, there will be two openings of 110 ft. each. The Provincial Government, Esquimalt & Nanaimo Railway and British Columbia Electric Railway are contributing towards the cost of the bridge. The bridge is to be designed of sufficient width to carry two tracks for the electric railway, a roadway on each side of these tracks of about 11 ft., and on the north side of the bridge provision is made for a single track for the E. & N. Railway, as it has already freight yards on the east side of the harbor and wishes to still retain the right to bring freight into the city. The total length of the bridge will be about 500 ft., not including approaches. The approximate cost, depending on what type of bridge is adopted, and the width, will be about $400,000, not including approaches or the purchase of the necessary land. The city has undertaken to provide the approaches and to purchase property on the east side of the harbor. The estimated cost of the land is about $225,000, and the approaches, of which there will be two, one from Cormorant street and one from Johnson street, will cost approximately $50,000. The Provincial Government is providing the land on the west side of the bridge. Mr. C. H. Rust is the City Engineer.

Steel Forms for Concrete Sidewalk Construction

THESE forms consist of side pieces made of Standard Carnegie channel sections, 4, 5 or 6 in. in depth as required, reinforced every 4 feet with strengthening ribs. Adjustable clamps known as matrices, for holding the channels in place, and bolts used in the connections are important features of these steel forms. A complete set, with which 100 lineal feet of sidewalk 18 in. to 8 ft. in width can be constructed, includes 200 feet of side channels in lengths of 10 feet with connections, 20 matrices and 30 pins. The matrices are made in three pieces, two curved end pieces and one straight centre piece to each. The shanks of the curved pieces and the straight centre section have holes at 31-in. centres to permit of spacing the side rails to suit width of sidewalk. One curved piece of each clamp is fitted with an adjusting screw and the other with a flat shoe which gives a suitable bearing on the rail.

When setting up the forms, the side rails are lined up with the flanges outwards. Wooden distance pieces or separators corresponding in length to the required width of the finished sidewalk are placed between the rails. The matrices are then put on at 4-ft. centres and tightened up.


Sidewalk construction with steel forms.

The combination of side rails, matrices and separators make a rigid form in which the concrete is deposited.

When in place the matrices or clamps are well above the top of the concrete. Sidewalks can be made of any thickness up to the top of the side rails.

It is stated by the makers that on one $1,200 contract a saving in lumber and labor costs can be effected which will offset the cost of one set of steel forms, about $200. It is also claimed that lumber costs will be reduced 25 per cent. and a continuous and complete operation in setting, removal and replacement can be effected. The forms are adaptable to any surface conditions and are adjustable to any width to a fraction of an inch.

The equipment above described is manufactured by the Malone Steel Concrete Form Company, George L. Starks & Company, of Saranac Lake, N.Y., owners. Patents have been applied for in all countries.

The Canadian representative is A. E. Patton, 77 Somerville Avenue, Montreal. Several sets have been sold to Canadian municipalities, including Montreal, Longueuil, Verdun, Lachine, etc., and many contractors have purchased the equipment.

The illustration shows the forms in use. The height of clamps above the concrete is clearly shown.

The contract was awarded recently to Messrs. Shuttleworth & Black, contractors, Ottawa, for the construction of an addition to the present dry goods store of Chas. Oglivy, Limited, Montreal. When completed the new store will have a frontage on Nicholas street of 200 ft., and on Rideau and Besserer streets of 66 ft. Mr. W. E. Noffke, Ottawa, is the architect.

Sixteen grillage castings for the new Quebec bridge, now in course of construction, are being completed and shipped by the Longue Pointe Plant of the Canadian Steel Foundries, Limited. The weight of each casting is forty-three tons and the dimensions 21 ft. x 6 ft. 8 in. x 4 ft. The specifications of the Quebec Board of Engineers called for the best quality of material and workmanship, and a rigid works inspection was maintained through all stages of their manufacture. Upon arrival at destination they are bolted in pairs, two pairs to each concrete pier carrying the main columns of the bridge. All of the scrap metal used in making these castings was procured from the wreck of the old Quebec bridge and is of a very high grade of steel.

The Canadian Pacific has just published some interesting particulars about its big bridges. The system boasts hundreds of bridges, but four stand out with distinction and bulk. These are the Lethbridge Viaduct, the Outlook, the Edmonton and the Lachine bridges. The first is 5,327 feet long and 314 feet above the water level; with a weight of steel of 25,000,000 pounds, and cost $1,500,000. It was made up of 44 through plate girders of 67 feet long, 33 girders 100 feet long, and one 167 feet truss span supported on 33 steel towers. It required 645 cars to transport steel used in construction. The second bridge, across the South Saskatchewan River, is 3,004 feet in length, 140 feet above water level, and has a weight of 5,737,000 pounds of steel; cost $900,000. It has 240-foot truss spans, supported by concrete piers, with approaches consisting of three 80-foot, seven 60-foot, and nine 45-foot plate girder spans on steel towers. The third, over the North Saskatchewan, is 2,550 feet in length, is 152 feet above the water level and has 17,204,146 pounds of steel. This bridge cost $1,400,000. The fourth bridge—the Lachine, across the St. Lawrence—is 3,657 feet in length, is 60 feet above water level, has 28,462,931 pounds of steel, and cost $2,000,000—that is for converting into double track, besides the original cost of the structure, which was something like $1,500,000. There are three 80-foot, nine 120-foot, four 240-foot, two 270-foot, and two 408-foot spans. It has 19 piers and 3,500,000 rivets, and 3,500 cars were required to handle the material employed in the entire structure.

A bulletin issued by the Herbert Morris Crane & Hoist Company, Limited, Toronto, describes interesting features of the new Morris Telescopic Ash Hoist. This hoist was designed primarily for use in basements having trap doors to the sidewalk. The head of the hoist is raised into position simply and effectively and is returned to its place below the grade level when not in use. The separate lifting gear can be used for many other purposes around the building. The jib-head swings around to deposit the load right on the sidewalk. The Herbert Morris Company lately received an order for four of these hoists from the Board of Education of the city of Toronto.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Belleville, Ont.
It is understood that the city council contemplates laying cement walks in connection with the new Queen Mary School.

Dunnville, Ont.
Tenders for the construction of sewers on Park Ave., Ross Ave. and Cedar St., are to be called shortly. Plans are now being prepared by the town council.

Dundas, Ont.
Plans for a new reservoir and storage basin are being drawn by the town council. The engineers in charge are Messrs. McPhee, Kelley & Darling, of Hamilton.

Fort William, Ont.
The city council proposes to construct granolithic sidewalks on Donald St. and N. Syndicate Ave., also curbs on John, Harold, Marks and Norah Sts.

Hamilton, Ont.
It is understood that nothing will be done this year in regard to the proposed construction of an overflow sewer system.

Hamilton, Ont., Burlington
A by-law has been passed by the village council providing for the extension of the waterworks system into the new survey at a cost of $12,000.

Halifax, N.S.
Tenders will be received by the mayor until noon Aug. 19th, for the construction of granite block and sheet asphalt or bitulithic pavements. Specifications are at the office of the engineer, Mr. F. W. W. Doane, City Hall.

Milton, Ont.
The town council proposes to construct cement walks on Fulton, Main, Pine and Martin streets.

Niagara Falls, Ont.
The city council has decided to construct, by day labor, about 18,000 sq. yds. of brick pavements, with concrete curbs, on Main and Queen streets. A plant for the entire work will be required.

It is also proposed to lay 8-in. to 18-in. vitrified tile sewers on Barker, Joe and Third streets. This work will also be done by day labor. Estimated cost $12,000.

Ottawa, Ont.
Tenders will be received by the Sec. to the Board of Control until 4 p.m. Aug. 20th, for the supply and delivery of 1 cu. yd. concrete mixer; 2 tarvia tank delivery wagons; 1 trench tamping machine; 1 drain cleaning apparatus. Specifications, details and full particulars are to be sent with each tender.

Tenders will be received by Mr. L. K. Jones, Department of Railways & Canals, Ottawa, until noon, August 20th, for drainage work at Clement's Gully, Soulanges Canal. Plans, etc., are at the office of the Chief Engineer, at the Department, Ottawa, and at the office of the Superintending Engineer, Quebec Canals, New Birks Bldg., Montreal.

It is proposed by the city council to lay asphalt pavement on Rose Street between St. Patrick and Water streets. The estimated cost is $7,750.

Peterboro, Ont.
The construction of cement pavements on about 28 streets has been recommended by Board of Works. Plans have been drawn.

Regina, Sask.
The city council is calling for tenders for the supply of 2,016 lin. ft. Standard steel rails, 72 fish plates and ⅜-in. round bars in connection with the sewage disposal works. Specifications are with the engineer, Mr. F. McArthur.

Sudbury, Ont.
The sewerage extensions proposed by the town council consists of 4 miles of sewers, including a system for the west end of the town, and various extensions; also connections from the original system to the recently installed trunk system.

St. John, N.B.
The city council is about to call tenders for the construction of permanent sidewalks on the north side of King St.

The city council has authorized the renewal of 7,000 ft. of water mains on fifteen streets. The laying of about 1,000 ft. of 8-in. pipe in Protection street is also recommended.

Sherbrooke, Que.
The by-law which was submitted to the ratepayers calling for the expenditure of $200,000 on sewers, sidewalks, etc., has been defeated.

Sydney, N.S.
The engineer, Mr. N. Hay, invites tenders for the supply of 14-in., 12-in., 8-in., and 6-in. special valves for the waterworks department.

Trenton, N.S.
In addition to the construction of the water service, the Doane Engineering Company, of Halifax, will install a deep well pumping plant. The total cost is estimated at $25,000.

Toronto, Ont.
The mayor will receive contracts until Aug. 18, for addition and alterations to the high level pumping station. Plans are at the office of the city architect, City Hall.

Tenders will be received by the mayor until Aug. 18, for the construction of the following pavements. Asphalt on 9 streets, bitulithic on 3 streets, rocmac on 1 street, asphaltic concrete on 1 street, concrete walks on 6 streets. Plans are at the office of the Commr. of Works.

Victoria, B.C.
The city council has approved the laying of bitulithic surface concrete base on Oak Bay Ave., also pavement on Davie street. The estimated cost is $13,900.

Wingham, Ont.
The town council contemplates laying 8-in. tile sewers on Edward and John streets, putting in drains and purchasing drinking fountains for the town hall.

Watrous, Sask.
A by-law providing for the construction of cement sidewalks on several streets will shortly be submitted to the ratepayers.

CONTRACTS AWARDED

Grey Twp., Ont.
The township council has awarded to Mr. Henry Ward the contract for the construction of the Barron drain at 22½c per yard.

Hamilton, Ont., Burlington
The local firm of Messrs. Large & Peer has secured from the village council a contract for the construction of 1½ miles of concrete sidewalks at 13c per ft.

Lunenburg, Ont.
The village council has awarded to Mr. John Waldroff, of Newington, Ont., the contract for the contsruction of approximately 10,000 square feet of concrete sidewalks.

Montreal, Que. (Outremont)
A contract has been awarded by the town council to A. Forest, the local contractor, for a 2 x 3 brick sewer from St. Catherine Road to Springrave Avenue.

Moose Jaw, Sask.
The city council has awarded to Mr. E. F. Gedney, of Kerrobert, a contract for the construction of sanitary sewers at $15,979.90, and storm sewers at $13,676.

New Liskeard, Ont.
Messrs. Hill, Clarke & Francis have been awarded the contract for the construction of sewers and walks.

Point Grey, B.C.
The municipal council has awarded the following paving contracts: Ledingham & Cooper, 423 Hamilton St., Vancouver, Yew St., $6,952.50; H. Kaiser & Co., 29th Ave., $13,105.50.

Regina, Sask.
The city council has awarded to Ham, Baker & Co., Ltd., of Langley Green, Birmingham, England, the contract for the supply of 4 travelling distributors, at $3,000.

The Canadian Northern Railway Company has awarded to the Bitulithic & Contracting Company the contract for the construction of bitulithic pavement in front of the freight sheds on Albert street.

Contracts for the construction of domestic and storm sewers have been let by the city council to H. G. McVean, Westmann Chmbrs., $26,355.71; R. J. Lecky Co., Ltd., 304 Northern Crown Bank Bldg., $50,068.40.

Toronto, Ont.
The following paving contracts have been transferred from the Commissioner of Works. Godson Contracting Co., Manning Chmbrs., 5 streets, $21,144; Constructing & Paving Co., Confed. Life Bldg., 4 streets, $23,724; Asphaltic Concrete Co., 74 King St. E., rocmac on Balsam Ave., $8,126.

South Vancouver, B.C.
The municipal council has awarded a contract to the Columbia Bitulithic Co., Ltd., Dominion Trust Bldg., Pender St., W. Vancouver, for the construction of bitulithic pavement on bituminous base on Victoria road.

Railroads, Bridges and Wharves

Brockville, Ont.
Plans have been drawn for the construction of a steel bridge to replace the present wood structure known as the Kingston bridge. The estimated cost is $15,000.

Banff, Alta.
Plans have been drawn and approved by the Public Works Department for the construction of the Banff Avenue bridge. The structure will be of concrete construction and cost approximately $200,000.

Calgary, Alta.
Tenders will be received by the City Commissioners until 10 a.m., August 26th, for the construction of a 4-span reinforced concrete bridge over Elbow River with abutments, piers and approaches. Plans and specifications are at the office of the engineer, Mr. Geo. Craig.

Haileybury, Ont.
Plans have been drawn by the Public Works Department for the construction of improvements to the harbor. The cost is estimated at $8,000.

Jackfish, Ont.
The Public Works Department contemplates the construction of a 150-ft. bridge of crib construction.

Montreal, Que.
Surveys have been made for the construction of underground conduits. Tenders will be called shortly. The engineer is Mr. Clarson, New Birks Bldg.

Quebec, Que. (St. Malo)
Plans have been prepared by the Commissioners of the Transcontinental Railway for the erection of a shop for the general construction of engines, locomotives, cars, etc. No tenders have been called as yet.

Sudbury, Ont.
Tenders for the construction of four concrete bridges are invited by the town clerk, Mr. W. J. Ross, until August 17.

CONTRACTS AWARDED

Cornwall, Ont.
The following contracts have been awarded on the Glengarry & Stormont Rly. Co.'s buildings. General contractors, Williams & Evans; carpentry, Atchison & Co.; heating station, J. G. Hunter, 170 Pitt St.; electrical, Stormont Light, Heat & Power Co.; interior fittings, station, Atchison & Co.

Walkerton, Ont.
The following bridge contracts have been let by the Bruce county authorities. Steel, Hunter Bridge Co., Kincardine, Ont.; concrete, J. A. McKinnon, Gresham, Ont.

Weyburn, Sask.
The city council has awarded a contract to Smith Bros. & Wilson, Ltd., Hamilton St., Regina, for the cement construction in connection with the 3rd street bridge.

Woodstock, N.B.
The St. John & Quebec Rly. has awarded to Mr. T. D. LeBlanc, of Lakeburn St., Moncton, N.B., the contract for the new station.

Public Buildings, Churches, Schools, etc.

Belleville, Ont.
The Belleville Club authorities have purchased the Schuster Block and intend rebuilding and equipping it for a first-class club house.

Campbellford, Ont.
Tenders for the erection of the post office and customs house will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until Aug. 24th. Plans are at the office of the Dept., Post Office, Campbellford, and Station "F," Toronto.

Ford City, Ont.
Tenders for the erection of a town hall and fire hall will be received by the reeve, Mr. Chas. T. Montreuil, until Aug. 18th. Each building will be of two storeys, and of concrete and brick construction.

Messrs. G. Jacques & Co., of Windsor, are drawing plans for the erection of a town hall on Sandwich street. The estimated cost is $16,000.

Fort George, B.C.
The Prov. Govt. Dept. of Public Works proposes to erect a 4-room school building on 8th and Victoria St., and another at the Crescent.

Grosse Isle, Que.
Tenders will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. Aug. 24th, for the erection and completion of buildings for the infectious disease hospital. Plans, etc., are at the office of J. A. Tremblay, Dist. Engineer, Montmagny, A. Dupuis, Dist. Engr., Quebec, and at the Dept., Quebec.

Hagersville, Ont.
It is proposed to erect a Roman Catholic Church here. The Rt. Rev. J. M. Mahoney, of Hamilton, has the matter in hand. Funds are being raised.

Hamilton, Ont.
The building of the public garage, projected by the A. Bell Company, has been postponed until the fall.

Tenders on the erection of the "Southam Home" on the mountain top, will be called shortly. The architects are Messrs. Stewart & Witton, 7 Hughson street south.

Nothing will be done until October in regard to the proposed alterations and additions to Christ Church Cathedral.

Hespeler, Ont.
The building committee of the Lutheran Church have decided to have plans and specifications prepared for additions to the church and choir loft.

Haileybury, Ont.
The erection of a mines school building on Latchford street, at a cost of $10,000, is contemplated by the School Board. The building will contain an assay plant, and probably small mill machinery.

Indian Head, Sask.
The ratepayers have passed a by-law to raise the sum of $18,000 for the purchase of a site and the erection of a new high school.

Maxville, Ont.
The erection of a 4-room school building is being considered by the School Board.

Moncton, N.B.
Tenders are in for the new St. John's Presbyterian Church, but the contract is not yet awarded. Plans are now being prepared for the heating system. The architect is Mr. H. G. Jones, of 127 Stanley street, Montreal.

Montreal, Que.
The Board of Commissioners has decided to do nothing further this year in regard to the proposed market on St. James street. The question of additions to the city hall has also been postponed.

The council has decided not to proceed with the erection of the proposed city stores and garage this year.

Montreal, Que., Lachine
Tenders for the erection of a fire station will be called shortly by the town clerk, Mr. H. Charette. Messrs. Benoit & Girard, of Southam Bldg., Montreal, are the architects.

Montreal, Que., Westmount
Mr. Kenneth G. Rea, of the Guarantee Bldg., Montreal, is the architect for the new city hall on Sherbrooke St.

Montreal, Que. (Outremont)
The proposed fire station on Justine street will not be built this year.

New Westminster, B.C.
Plans have been completed for additions to the court house, at a cost of $70,000. Messrs. Gardiner & Mercer are the architects.

Ottawa, Ont.
Tenders will be received by R. C. Desrochers, secretary to the Public Works, Department until Aug. 24th, for the erection of the experimental farm. Plans, etc., are at the office of the department here.

Quebec, Que.
The St. Matthews Church congregation has abandoned the idea of the erection of the Wolfe Memorial Church on Des Braves avenue.

Regina, Sask.
Plans are being drawn by Mr. J. E.

Fortin, for the erection of a Roman Catholic Church on Dewdney avenue, at an estimated cost of $30,000.

Ste. Therese de Blainville, Que.
Tenders for post office fittings will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m., August 21st. Plans, etc., are with Mr. Hector Leboeuf, Clerk of Works, Ste. Therese de Blainville, R. L. Deschamps, Overseer, Montreal Central Post Office, and at the Department, Ottawa.

Sydney, N.S.
Plans for the new hospital will be ready very shortly, and tenders will be called in about two weeks. Mr. L. R. Fairn, of Aylesford, is the architect. The estimated cost is $66,000.

Saskatoon, Sask.
The Saskatoon County Club have decided to postpone the erection of their new club house until next year.

Shawville, Que.
Tenders for the erection of a public building will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. Aug. 24th. Plans, etc., are at the office of the Dept., Ottawa, and with the Postmaster, Shawville.

Toronto, Ont.
Tenders will be received by the Board of Control until Sept. 1st, for the erection of the North Yonge St. jail building. The plans, which are at the office of the city architect, call for a building of 2 storeys and basement, 200 ft. by 65 ft., of reinforced concrete and brick construction. The estimated cost is $80,000.

The Works Committee has adopted a report for the construction of 4 disposal plants instead of one central plant. The report is to be presented to the council for approval.

Toronto, Ont.
Tenders for structural steel and carpentry work connected with the erection of the new Registry Office on Elizabeth street will be received by the Board of Control until August 18th.

Weyburn, Sask.
The erection of a public library is being discussed by the city council.

Premier Scott has promised the council that the work on the proposed court house and registry office shall be started shortly.

Winnipeg, Man., Fort Rouge
Tenders on the erection of postal station "C" will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until August 31st. Plans are with H. E. Matthews, Supt. Arch., Dom. Public Bldgs., Winnipeg, with Postmaster, Brandon, Man., and at Dept., Ottawa.

Winnipeg, Man., Kildonan
Plans have been drawn by Messrs. Pratt & Ross, for the erection of a church for the John Black Memorial Presbyterian Church, at an estimated cost of $40,000. Tenders will be called shortly .

Wiarton, Ont.
The time for receiving tenders for the erection of the post office and armouries has been extended to August 31st. The plans are with the postmaster, Wiarton, at the office of Mr. Thomas Hastings, Postal Station "F," Toronto, and at the Public Works Department, Ottawa, where tenders should be addressed.

CONTRACTS AWARDED

Brandon, Man.
The folowing contracts have been awarded on the erection of a public school on the corner of 23rd street and Louise avenue. General contractor, masonry, carpentry and steel, E. Willows, 2407 Victoria Ave., $36,185; roofing, Mitchell & McGregor, 819 Rosser $368; plumbing, Brandon Heating and Plumbing Co., Bell Block, $3,427; electric, Geo. Hinners, 821 Princess, $560. Heating not let. Two storeys, 80 x 70, Sidney Man "Rustic" brick and hollow tile construction.

Brantford, Ont.
Mr. A. J. Croman of this city has been successful in securing the contract for the alterations to Darling Street Presbyterian Church.

Boscurvis, Sask.
Mr. D. Manning, of 2041 St. John St., Regina, has secured the contract for the erection of the new school building.

Burford, Ont.
The Public Works Department has awarded the contract for the erection of the post office to Messrs. P. H. Secord & Sons, of 133 Nelson street, Brantford.

Chatham, Ont.
The Canadian Frost & Winchester Company, of London, were the successful tenderers on the alterations and additions to the "McKeough" school. The amount of the contract is $32,000.

It is understood that Mr. Thomas McKie is the general contractor for the additions to "Queen Mary" school. The work will probably not be proceeded with at present.

Fort Qu'Appelle, Sask.
The general contractor for the erection of the new sanitarium is the Parsons Construction and Engineering Company, of Regina. The contract for the construction of the 100 ft. chimney has been let to the Waite, Fullerton Company, of Regina.

Halifax, N.S.
The Board of School Commissioners have awarded the following contracts. General contractors, S. Marshall & Son, Keith Bldg., Barrington St., $29,533; heating, Farquhar Bros., Ltd., 16 Barrington St., $3,895. Addition and alterations to Oxford Street school, general contractors, Freeman Bros., 13½ Carleton St., $29,600; heating, Longard Bros., Hollis St., $6,190. Addition and alterations to LeMarchant Street school, general contractors, Freeman Bros., 13½ Carleton St., $6,100; heating, Longard Bros., Hollis St., $2,240.

Ottawa, Ont.
Mr. J. R. Fogle, of 384 Bank Street, has secured the contract for alterations and additions to the Jewish Synagogue on James Street.

The Public Works Department has awarded to the Dominion Radiator Co., of North Dufferin St., Toronto, the contract for the installation of the heating system at the Eastern Block.

Peterboro, Ont.
The following contracts have been let in connection with the erection of the additions to the Lake school. General contractor, A. Rose, 303 Maitland St.; masonry, P. Johnston; carpentry, N. Bibby, 265 Romaine St.; other trades are not yet let.

Sackville, N.B.
The School Board has awarded the following contracts: Main street school, Mr. J. A. Hicks; Queen's road school, Mr. Edw. Milton.

Sandwich, Ont.
The Public School Board has awarded to Messrs. Wells & Gray, of Windsor, the contract for the erection of the new school.

Sarnia, Ont.
The contract for the erection of the Devine Street Methodist Church has been awarded to Mr. Jas. Shanks, of Wellington street. A pipe organ and seating will be required.

Sydney, N.S.
The city council has awarded the contract for the erection of a fire hall in Ward 5 to Messrs. Chappell Bros. & Co., at $13,602.

St. John, N.B.
The Board of Hospital Commissioners has awarded to Messrs. A. R. C. Clarke & Son, of 51 Water street, the contract for the erection of the tuberculosis hospital and power house.

Toronto, Ont.
The following contracts have been awarded in connection with the erection of the Upper Canada College buildings at Norval. Masonry, H. N. Dancy & Son, of Mail Bldg., Toronto; steel, Hamilton Bridge Co., Hamilton, Ont.; steel sash, H. Hope & Son, 45 King St. W., Toronto; carpentry, Oshawa Interior Fittings Co., 131 Delaware Ave., Toronto; plumbing, heating and ventilating, W. J. McGuire, Ltd., King St. W., Toronto; painting, W. M. Weeks, 37 Wilton Ave.; roofing and sheet metal, A. Matthews, Ltd., 256 Adelaide St. W., Toronto.

Vancouver, B.C.
The contract for the erection of "Strathcona" School, at the corner of Pender street and Jackson avenue, has been awarded to Messrs. McDonald & Wilson, of Birks Bldg., who are inviting sub-tenders.

Business Buildings and Industrial Plants

Arnprior, Ont.
Tenders received on the erection of the proposed factory for the Arnprior Felt Company were too high. It is understood that the plans will be revised and the work done by day labor.

Aylmer, Ont.
Plans have been drawn by Mr. Chas. White for the erection of a garage. The estimated cost is $5,000.

Brampton, Ont.
The representative of the Clinton Motor Car Company, of King St., Clin-

ton, is looking for a site suitable for the erection of a factory.

Estevan, Sask.
The Denison Fireproofing Co. of Mason City, Iowa, U.S.A., has secured a factory site. The construction of a hollow brick plant will be started immediately.

The construction of the plant of the Estevan Clay & Pottery Company will be started very shortly. Messrs. Frid, Lewis & Co., of Winnipeg, are the general contractors.

Edmonton, Alta.
Plans have been drawn by Mr. E. W. Morehouse, for the erection of an office building on the corner of Jasper avenue and Sixth street. The building will be 4-storeys high, of brick and stone construction, and is expected to cost about $100,000.

Mr. C. Roberts has obtained a permit for the erection of stores and apartments on 102nd street, at a cost of $30,000. The building will be a 3-storey one of brick construction.

Fort George, B.C.
The Royal Bank has purchased a site at the corner of Central avenue and Hammond street for the erection of branch premises.

Grimsby, Ont.
The Consumers' Box & Lumber Co., Ltd., Ernest Ave., Toronto, are considering the rebuilding of their backet factory recently destroyed by fire.

Hamilton, Ont.
The Chipman & Holton Knitting Co., of 122 Mary Street, have decided to posstpone indefinitely the proposed alterations and additions to their factory.

It is understood that the additions to Mr. Geo. Swannick's theatre on South James Street will not be started before next year.

The Commonwealth Realty Company has abandoned the idea of erecting a store on East King street.

Messrs. Stewart & Witton are still working on the plans for the hospital on the mountain top. The building will be a 3-storey one, containing 8 wards, with accommodation for 500 patients.

The Stanley Steel Works Co., of New Britain, Conn., has absorbed the Canada Steel Co. The new company will enlarge the present building and erect rolling mills, for which new machinery will be required.

Hamilton, Ont.
The Bell Telephone Company have decided not to erect their Garfield avenue building this year.

The erection of stores and apartments on King street west by the Globe Realty Company has been postponed, and it is understood that nothing will be done this year.

Hamilton, Ont., Dundas
The Canada Malting Company purposes putting a new roof on their malt house and all premises; probably metal or slate will be the material used.

Montreal, Que.
The Harbor Commissioners are having plans drawn for the erection of a warehouse on Beaudry street. The estimated cost is $100,000. The architect, Mr. F. W. Cowie, of 57 Common street, will call for tenders shortly.

Nothing further will be done until the fall or next spring in regard to the projected factory of the Tuckett Tobacco Company.

The erection of the picture theatre on St. Lawrence and Ontario streets, for which Mr. L. A. Amos has drawn plans, will be postponed until late in the fall.

Tenders for additions to the bakery of Mr. Jas. Strachan, 246 City Hall Ave., will be received by the architect, Mr. Sydney Comber, of Green avenue.

Tenders have been received for the erection of the branch of the Hochelaga Bank at the corner of Beaubien and Chateaubriand streets. The contract will be awarded shortly.

New Westminster, B.C.
The city council has approved of leasing a site to the Pacific Chocolate Co., 16 Front St. E., for the erection of a factory to replace the one recently destroyed by fire.

Ottawa, Ont.
Mr. J. Albert Ewart, of the Booth Building, has drawn plans for alterations to the warehouse of Messrs. W. & J. Graham, on Sparks street.

Sarnia, Ont.
Dr. Kelly has postponed indefinitely the building of the proposed store and office building on Christina street.

St. John, N.B.
Mr. F. E. Williams, of Princess St., proposes to build a new theatre on the site of the one on Carleton street which was burnt some time ago.

Toronto, Ont.
The Wilson Lumber Company, of 1 Spadina Ave., has had plans drawn for the erection of stores on Roncesvalles avenue.

North Vancouver, B.C.
Tenders for the construction of the remaining portion of the Dominion Shipbuilding & Drydock Company's plant at Lynn Creek will be received by the company until Sept. 1st. The site comprises 140 acres, and the total estimated cost of the project is $5,000,000.

Windsor, Ont.
Mr. T. Z. Humphries is drawing plans for additions to the factory of the Central Ice & Storage Company. The estimated cost is placed at $10,000.

Winnipeg, Man.
The erection of a $90,000 office building on King street by a client of Mr. D. W. Bellhouse has been postponed until next year.

Waterdown, Ont.
The Wentworth Orchard Co. of Canada, of Dundas, have had plans drawn for a 1-storey addition to their jam factory.

CONTRACTS AWARDED

Calgary, Alta.
The Guta Percha Rubber Company, of Toronto, have awarded the contract for the erection of their Calgary warehouse to Messrs. Jones & Little, of Bow River, and 6th street. It is understood that some little time will elapse before the work is started.

Montreal, Que.
The following contracts have been awarded in connection with the erection of the Montreal Arena Company's artificial ice plant. Masonry and carpentry, Reid, McGregor & Reid, Drummond Bldg.; steel, Structural Steel Co., New Birks Bldg.; roofing, Geo. W. Reed & Co., 37 St. Antoine Street.

Ottawa, Ont.
The contract for masonry in connection with the alterations to Mr. E. A. Oliver's store on Rideau street has been let to Mr. F. McCullough, of 181 Waller street.

Tillsonburg, Ont.
The contract for cement work in connection with the erection of the large garage on Oxford street for Mr. C. H. Mabee, has been let to Mr. G. A. Thomas, of Pearl street.

Residences

Gimli, Man.
J. Joy, P.O. Box 85, Gimli, has under consideration the erection of a residence at Willow Point. The estimated cost is $22,000.

Hamilton, Ont.
The client of Mr. Grayson W. Brown, of the Clyde Block, has decided to postpone the erection of his proposed residence.

Moncton, N.B.
Mr. C. J. McCarthy, of 166 Highfield street, will not proceed with the erection of his new house this year.

Montreal, Que.
Recent permits issued include: H. Brunelle, 122 Prefontaine street, for flats, to cost $9,000; P. J. Charlebois, 1234 Hubert street, for flats, to cost $5,000; Duncan Dube, 616 Henri Julien street, flats, to cost $12,000; Patrick Scheffer, 2222 St. Denis St., flats, to cost $10,000; Dame U. Bonhomme, 169 Monk Blvd., flats, to cost $6,000; O. Ouellette, 540 Desery street, flats, to cost $20,000.

Montreal West, Que.
Mr. E. D. Lee, of 161 Ballantyne Ave., has obtained a permit for the erection of a $5,500 residence on Wolseley Avenue.

Montreal, Que., Notre Dame de Grace
The Hampton Realty Co. will not proceed with the proposed building operations this year.

Montreal, Que. (Outremont)
Mr. G. A. Monette, 706-83 Craig W., architect, invites tenders on the erection of a residence for Mr. J. C. Lamothe.

Montreal, Que., Westmount
Messrs. Wright & Son, of 204 St. James St., have drawn plans for the erection of 16 residences on Roslyn and Grosvenor streets.

Ottawa, Ont.
The erection of a residence on Russell street is being considered by Mr. Geo. Lett, of 309 Sunnyside.

Mr. R. W. Hamilton, of 81 Echo Drive, has under consideration the erection of a residence on Hawthorne street.

Mr. J. Poleman, of 250 Bell street, proposes to erect a $5,000 residence on Crawford street.

(Continued on page 78)

Tenders and For Sale Department

Notice to Contractors

Street Plant

Sealed tenders addressed to the Chairman and Members of the Board of Control will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., **Thursday, August 20th, 1914**, for the supply and delivery of:

1 cubic yard Concrete Mixer.
2 Tarvia Tank Delivery Wagons.
1 Trench Tamping Machine.
1 Drain Cleaning Apparatus.

Specifications, details and full particulars must be sent with each tender.

Tenders may be submitted on one or all of the above-mentioned articles.

A cheque for 5 per cent. of the total value must accompany each and every tender.

Any tender received after the above stated time will be declared informal.

The Corporation does not bind itself to accept the lowest or any tender.

F. C. ASKWITH,
Acting City Engineer.
Ottawa, August 7th, 1914. 32

Tenders for the Construction of a Bridge on the Don Section of the Bloor St. Viaduct

Tenders will be received, by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Monday, October 5th, 1914**, for constructing across the Don Valley a bridge consisting of five steel arch spans, with piers and approaches; the width being eighty-six feet, and the length, approximately sixteen hundred and eighteen feet. Bidders may obtain specifications, including plans and form of tender, on application to the Commissioner of Works, Toronto, after paying to the Commissioner of Works twenty-five dollars for each set, this sum to be refunded upon return of plans. The Engineer's Estimate of Quantities will also be sent on request. Specifications, including plans, may be seen at the offices of the Commissioner of Works, Toronto; the Commercial Intelligence Department of the Board of Trade, London, England; the Engineering News, New York; Engineering and Contracting, Chicago; and Engineering, London, England.

Those desiring to submit tenders on reinforced concrete construction for the above bridge, are hereby notified that they may prepare and submit, without any expense whatsoever to the City, their own plans and specifications, based on the loading given in the specifications for steel construction, and may tender on the same. These tenders will be received up to noon on Monday, October 5th, 1914.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering, as prescribed by City By-laws must be strictly complied with, or tenders may be declared informal.

A deposit in cash, or a marked cheque, equivalent to 2½ per cent. of the amount of the tender, payable to the order of the City Treasurer, must accompany each tender, which deposit will be retained until provisions of by-law 4294 are complied with.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto, July 21st, 1914. 30-33

Greater Winnipeg Water District

Tenders for Aqueduct Construction

Sealed tenders addressed to the undersigned will be received up to noon of **Saturday, 19th September, 1914**, for the construction of Eighty-five miles of concrete aqueduct in five sections of approximately equal length.

Plans, specifications and form of tender can be secured after July 20th, 1914, by application to the District accompanied by certified cheque for One Hundred Dollars payable to the District, which deposit will be returned upon submission of tender or return of documents.

Bidders may tender on any section or on any number of sections.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,
Chairman of Commissioners
901 Boyd Building,
Winnipeg, Man., July 6, 1914. 30-36

Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements (wharf) at Hamilton, Ont.," will be received at this office until 4 p.m., on **Monday, August 31, 1914**, for the construction of Harbour Improvements, being a wharf and approach at the foot of Wentworth Street, in the City of Hamilton, County of Wentworth, Ontario.

Plans and forms of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, Ont.; Windsor, Ont., and on application to the Postmaster at Hamilton, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

Note.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 30, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—63872. 31-32

Sealed tenders addressed to the undersigned and endorsed "Tender for Dairy Building, Experimental Farm, Ottawa, Ont.," will be received until 4 p.m., on **Monday, August 24, 1914**, for the above mentioned building.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Pub- the amount of the tender, which will be forfeited if the person tendering decline to enter into a lic Works, equal to ten per cent. (10 p.c.) of contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, July 31, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—62965. 31-32

Department of Railways & Canals

New Welland Ship Canal

Notice to Dealers in Portland Cement

Sealed tenders, endorsed "Tender for Cement," will be received by the undrsigned up to 10 o'clock on **Tuesday, August 25th, 1914**, for the supply of 2,500,000 barrels of Portland Cement which will be required in the construction of the new Welland Ship Canal, to be delivered as the work progresses, in such quantities, at such places along the Canal and at such times as the Department may require. It is estimated that the total amount will be consumed within the next four years.

Tenders may be submitted for the whole or any portion of the quantity required.

The Cement must be in conformity with the Department's standard specification for Portland Cement. Specifications, forms of tender and full information can be obtained upon application to the Purchasing Agent, Department of Railways and Canals, Ottawa.

The Department does not bind itself to accept the lowest or any tender.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary
Department of Railways and Canals,
Ottawa, July 25th, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—64842. 31-32

Sale of Railway by Tender

The undersigned will receive tenders for the purchase of The Ontario West Shore Railway up to **Saturday, the 15th day of August, A.D. 1914.**

1. The property offered for sale consists of the railway franchise, extending from Goderich to Kincardine, and covering other territory in the counties of Huron, Bruce, Grey, Lambton and Middlesex.

2. The Road is built from the C. P. R. crossing, close to the Town of Goderich, to Kintail. Grading has also been done from Kintail to Pine River. The distance constructed and on which ties and rails are laid is 14½ miles.

3. The material on hand consists of a locomotive, bridge material, rails, bolts, spikes, ties, posts, etc., for the completion of the road and grading same into a running concern between Goderich and Kincardine within a time to be agreed upon with the undersigned Trustee, who is prepared to enter into a contract for the completion of the work and making such other arrangements as may be necessary for the completion of the road.

There will be a reserve bid.

Further particulars may be had from the undersigned, or his solicitors, or Mr. Charles Garrow, Barrister, Goderich, or P. A. Malcomson, Barrister, Kincardine.

Dated at Goderich this 11th day of July, 1914.

THOMAS STOTHERS, Trustee,
Dungannon, P. O.

Proudfoot, Hays & Killoran,
Goderich. 31-32

Sealed tenders addressed to the undersigned, and endorsed "Tender for Wharf at Kensington, Ont.," will be received at this office until 4.00 p.m. on **Monday, August 31, 1914**, for the construction of a wharf at Kensington, Algoma District, Ontario.

Plans and form of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers at Sault Ste. Marie, Ont.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Desbarats, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $10.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, July 30, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—64623. 31-32

Tenders for Structural Steel and Carpentry and Joinery Work

Registry Office

Separate tenders, addressed to the undersigned, will be received by registered post only up to 12 o'clock noon on **Tuesday, August 18th, 1914**, for the necessary Structural Steel and the Carpentry and Joinery work required in connection with the erection of the new City Registry Office, to be located on a site bounded by Albert, Elizabeth, Louisa, and Chestnut street, Toronto.

Copy of plans, specifications, and tender form, together with all information relative thereto, may be procured at the offices of Mr. Charles S. Cobb, Architect, 71 Bay Street, Toronto.

The usual conditions pertaining to tendering, as prescribed by City By-law, must be strictly complied with, and envelope containing tenders must be plainly marked on outside as to contents.

A bond from a guarantee company, satisfactory to the corporation, will be accepted in lieu of the personal sureties provided for in the tender form.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto, July 30th, 1914. 32

Notice to Contractors

Tenders will be received by registered post only addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, August 18th, 1914**, for the construction of the following sewers, viz.:—

Beresford Ave., MacGregor Ave. to Annette St.
Evelyn Cres., Glendonwynne Rd. to Fairview Ave.
Indian Grove, 520 ft. north of Ridout Street to Bloor Street.
Indian Road, Conduit Street to Humberside Ave.
Lincoln Avenue, Runnymede Road to west end.
MacGregor Ave., Durie Ave. to Runnymede Rd.
Slatky Ave., Lincoln Ave. to south end.
Spears Ave., Colbeck St. to Annette Street.
West Toronto Sewer System, Div. No. 2, Outlet from 315 ft. north of Conduit Street on Woodville Ave. to Birtle Ave. and Indian Rd., via lots Nos. 98 and 134, Western Avenue and Birtle Avenue.
Woodside Ave., Fairview Ave. to Evelyn Ave.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer, not members of the City Council or officers of the Corporation of the City of Toronto), or, in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, July 29th, 1914. 32

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Campbellford, Ont.," will be received until 4 p.m., on **Monday, August 24th, 1914**, for the above mentioned work.

Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, at the Post Office, Campbellford, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 1st, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—64964. 31-32

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Wiarton, Ont.," will be received until 4 p.m. on **Monday, August 31, 1914**, for the construction of a Public Building at Wiarton, Ont.

Plans, specifications and form of contract can be seen and forms of tender obtained on application to the Postmaster at Wiarton, Ont., at the office of Messrs. Forester & Clark, architects, Owen Sound, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 6, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—65008. 32-33

Tenders

Tenders addressed to His Worship the Mayor and endorsed "Tender for Paving," will be received at this office until noon on **Wednesday, August 19th, 1914**, for the construction of granite block and sheet asphalt or bitulithic pavement.

Specifications and all other information may be obtained at the City Engineer's Office.

The right is reserved to reject any or all tenders or to accept any tender that may be considered in the interest of the City.

Satisfactory security will be required.

J. J. HOPEWELL,
Clerk of Works,
Halifax, N.S.

32

Department of Railways & Canals

TRENT CANAL
Bobcaygeon Section

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Bobcaygeon Section, Trent Canal," will be received at this office until 12 o'clock noon on Monday, August 17th, 1914.

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Superintending Engineer, Trent Canal, Peterborough, Ont.

Copies of plans and specifications may be obtained from the Department on the payment of the sum of fifty dollars. To bona fide tenderers this amount will be refunded upon the return of the above in good condition.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque on a chartered bank of Canada for the sum of $10,000, made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering decline entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderer will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary.

Department of Railways and Canals,
Ottawa, 23rd July, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—64802. 31-32

Agents Wanted

Large firm making diaphragm pumps with improved patent valves wants to secure agents in Canada. Pumps made in all capacities up to 14,000 gallons per hour. Workable by hand or mechanical power. Address Box 70, Contract Record & Engineering Review, Toronto. 32-37

To Civil Engineers and Contractors.—Technical graduate, age 28, single, experienced in railroad and general construction. First class draughtsman and instrument man, desires position. Apply Engineer, care Contract Record, 119 Board of Trade Bldg., Montreal. 29-30-31-32

Situation Wanted

ARCHITECT.—Excellent recommendations as designer, draughtsman, and perspective artist. Reinforced concrete and steel specialist. Address 6 Kinkora Avenue, off MacKay, Montreal. 31-32

Position wanted by reliable waterworks and sewers construction foreman. Good draughtsman; knowledge of transit and level; excellent references. Box 69, Contract Record, Toronto. 31-34

Residences

(Continued from page 75)

The erection of a residence on Breezehill is contemplated by Mr. James Burke, of 268 Carruthers street.

The erection of a residence on Irving street is being considered by Mr. Fabun Sayer, of 76 Stirling street.

Regina, Sask.
Mr. F. J. Robinson, of 2839 Angus street, has been granted a permit for the erection of a $7,000 residence on Angus street.

Sudbury, Ont.
Mr. W. H. Owens, of the Baikie Gill Block, has submitted sketches to Mr. Chism for the erection of a $10,000 apartment block in the Lake section. The same architect has drawn plans for a residence for Mr. Dixon.

Saskatoon, Sask.
Nothing will be done this year in regard to the erection of the large apartment block on 4th avenue projected by Mr. Anthony Le Jeune.

Toronto, Ont.
Mr. J. H. Stanford, architect, corner of Bloor St. and Ossington Ave., has drawn plans for the erection of a $33,000 apartment house on Charles St. E., for Messrs. J. T. & H. Hutson, 43 Victoria Street.

Windsor, Ont.
Nothing further will be done until next year in regard to the proposed erection of a residence for Mr. W. R. Bonds, 231 Ouellette street.

Winnipeg, Man.
Mrs. F. Ritchie, of 597 Jubilee Street, has under construction the erection of a stone residence estimated to cost $10,000.

Mr. A. W. Scovil, of 63 Oxford Street, has under construction the erection of a residence at an estimated cost of $15,000.

Winnipeg, Man. (Fort Rouge)

Mr. F. Ritchie, of 597 Jubilee Street, proposes to erect two $10,000 residences on Jubilee street.

Winnipeg, Man., Norwood
Mr. McIntosh, of Lorne Ave., has under consideration the erection of 3 residences on Lorne Ave. The estimated total cost is $18,000.

The Naidanac Building Corporation proposes to erect a residence on Lorne Ave., at a cost of $5,500.

The erection of a $7,000 residence on Lisgar Avenue is proposed by Mr. E. H. Bailey, of 331 Spadina Ave.

Winnipeg, Man., St. Vital
Mr. W. J. Henderson, of 2652 Gallagher street, contemplates erecting a number of residences in near future.

The Windsor Park Construction Company, of 245 Notre Dame Ave., proposes to erect a number of residences on Windsor Park.

Winnipeg, Man., River Heights
Mesrs. Andrews & Sons, of Portage and Victor streets, may start this year on the erection of a residence on Oak street.

CONTRACTS AWARDED

Crysler, Ont.
The contract for the erection of the Rev. M. J. Leahy's manse, has been secured by Mr. Jno. Braithwaite.

Halifax, N.S.
The contract for the erection of 5 residences on Walnut St., for Seaboard Model Residences, Ltd., has been let to C. A. Mitchell, of New Glasgow.

Mr. R. W. Nickerson, of 8 Waterloo St., has secured the contract for the erection of a residence for Mr. H. D. Holloway, 249 Robie street.

Hamilton, Ont.
The masonry contract on the erection of an apartment house on Bay and Herkimer streets for a client of Messrs. Stewart & Witton, the local architects, has been let to Mr. Geo. E. Mills, 614 King Street East. The balance of trades will be let shortly.

Montreal, Que.
The following sub-contracts have been let in connection with the alterations to Miss Ella Foley's residence on University St. Stone, Morrison Quarry Co., 204 St. James St.; carpentry, N. Sarrazin & Co., 228 Duvernay St.; steel, Dom. Bridge Co., of Lachine; roofing, G. A. Powell & Co., 235 St. Urbain St.; store fronts, Easy-set Store Fronts, Dartnell, Ltd., 8 Beaver Hall Square.

Montreal, Que., Westmount
Mr. W. M. Irving, of the Guy Block, has secured the contract for the erection of two residences on Avenue Road for Mr. T. P. Howard.

Messrs. McDonald & McCall, of 4867 Sherbrooke St., have been awarded the contract for alterations to the residence of Mr. R. A. Webster, Roslyn St.

Ottawa, Ont.
The contract for the erection of a residence at Parkdale for Mr. Robert Reid, has been secured by Mr. R. E. McKinstrey, 91 2nd Avenue.

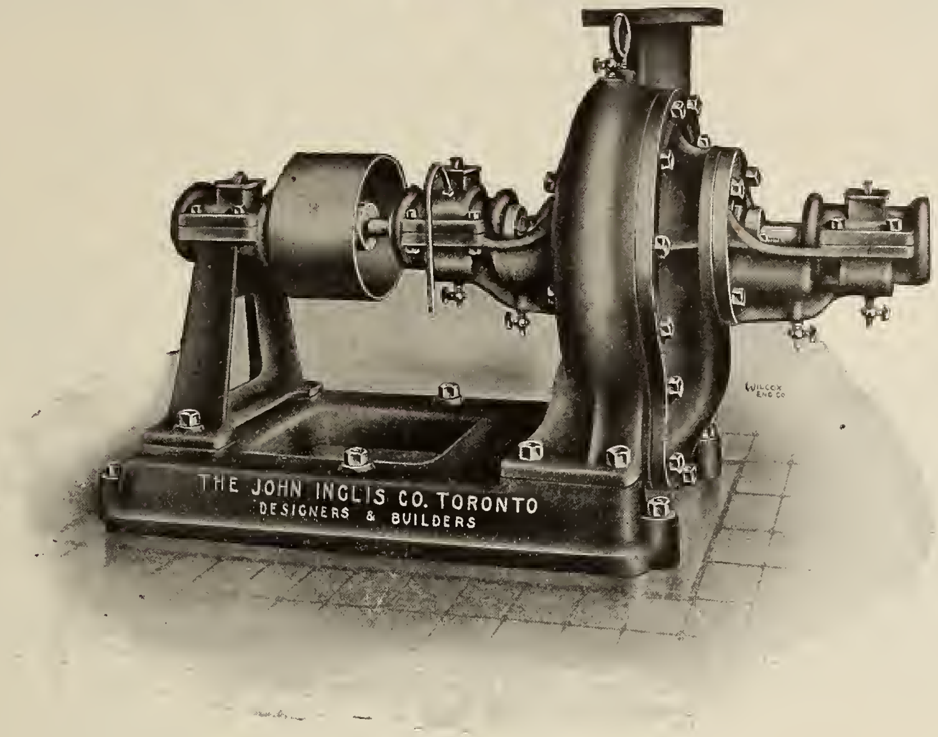
Regina, Sask.
The contract for the erection of Mr. G. S. Houston's residence and garage on Wascana Park has been let to Messrs. Normandy & Anderson, of 2915 Regina Ave.

Sarnia, Ont.
Mr. W. G. Giffen, who has the general contract for the erection of Mr. H. Neil's residence, is prepared to sublet some of the trades.

St. Andrews, Que.
Mr. J. P. McKimmie, of Lachute, has been awarded the contract for the erection of a residence for Mr. F. C. Shorey.

St. John, N.B.
The following contracts have been awarded in connection with the erection

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

of Mr. J. L. Thorne's residence on Princess street. General contractor, R. A. Corbett, Douglas Ave.; electrical, Frank Jones, Prince William street.

Victoria, B.C.
Mr. C. Boniface, of 214 Wildwood Avenue, has the general contract for the erection of a residence on Cedar Hill Road for Mr. J. Nichols. The estimated cost is $10,000.

The contract for the erection of Lieut.-Gov. T. W. Patterson's residence on Suffolk Road has been awarded to Mr. P. McKechnie, of 2358 Cadboro Bay Road.

Power Plants, Electricity and Telephones

Bamfield, B.C.
The Pacific Coast Cable Co., Ltd., of 448 Seymour St., Vancouver, have deposited plans with the Dept. of Public Works, Ottawa, for the construction of a cable line to Alberni.

Belleville, Ont.
The ratepayers will be asked to vote on August 3rd on the agreement with the Trenton Electric & Water Company for a 10-year franchise for street lighting.

The by-law calling for the installation of a lighting system has been passed by the ratepayers. The streets are to be lighted with the new gas-filled lamps.

Bolton, Ont.
The by-law providing for the introduction of the hydro-electric system into the town has been endorsed by the ratepayers by a large majority.

Chatham, Ont.
The city council has decided not to purchase the Chatham Gas & Electric Light Company's plant, but to have the Hydro installed as soon as possible.

North Grimsby Twp., Ont.
If the necessary by-law carries the Contract Power Company, of Hamilton, will install a lighting and power system. The plans are now in progress.

Port Arthur, Ont.
The ratepayers will vote August 6th on 2 by-laws, one to provide $22,000 for a double track and Y on Cumberland St., the other to provide $22,000 for street railway equipment.

St. John, N.B.
The work on the construction of the St. John Street Railway Company's barns is held up indefinitely on account of the prevailing financial conditions.

Tillsonburg, Ont.
The Tillsonburg Electric Car Company desires details or catalogues descriptive of 3¼ or 4-ton motor trucks left hand drive, also electric battery shop trucks of any capacity.

CONTRACTS AWARDED

Montreal, Que. (Outremont)
The town council has awarded the cable contract to Engene F. Phillips Elec. Works, Ltd., of DeGaspe Ave., at 28¼c per foot.

Moosomin, Sask.
The Ivanhoe Rural Telephone Co. has awarded to the Canada West Electric Ltd., of Regina, the contract for the installation of a telephone system.

Montreal, Que., Lachine
The town council has awarded to Dietrich, Ltd., 45 St. Alexander St, Northern Elec. & Mfg. Co., 814 Notre Dame W., the contract for 100 supports for electric lights.

Montreal, Que., Outremont
The town council has awarded the Northern Elec. & Mfg. Co., of 814 Notre Dame W., the contract for the supply of 23,000 ft. lead covered cable at 10c, and 3,000 ft. armoured cable at 16c.

Saskatoon, Sask.
The city council has awarded to Messrs. Escher Wyss Co., of 20 St. Nicholas, Montreal, a contract for the supply of two 4-million gallon centrifugal pumps, at $4,245, and 1 turbine-driven centrifugal boiler, at $1,250.

Shoal Lake, Man.
The following contracts connected with the installation of the electric lighting system have been awarded by the municipal council. Power house building, E. R. Snider; engine, Refrigeration & Engineering Co., Winnipeg (for Campbell Oil Engine); generator, switchboard, pole line material and construction, Canadian General Electric Co., Winnipeg.

Yorkton, Sask.
The town council has awarded the following power house contracts. General contractors, Parrott & Byers, 4th avenue., heating, plant, $3,433; Richie & Walters, Yorkton, concrete cooling tank, $2,613.

Miscellaneous

Belgrave, Ont.
The purchase of material for the manufacture of cement tile is contemplated by Mr. Jno. T. Bell.

Essex, Ont.
Mr. Joshua A. Hill is in the market for machinery for manufacture of motor cycles.

Halifax, N.S.
The Dom. Govt. Dept. Marine and Fisheries are about to purchase a marine boiler approximately 200 h.p. for His Majesty's dockyard at Halifax. Specifications wil lbe ready shortly.

The purchase of a 200 h.p. horizontal boiler is being considered by Moirs, Limited. Mr. C. Monahan is the buyer.

Tenders will be received by the city clerk, Mr. L. F. Monaghan, until noon August 24th, for 2,000 ft. 2½-in. fire hose with couplings complete. Couplings not to weigh less than 5 lbs. One piece 5-in. suction hose, 10 ft. long, without couplings. Marked sample and manufacturer's guarantee are to accompany tenders.

London, Ont.
The London Street Railway Company has purchased property, and proposes to erect a "White City" and equip various amusements.

Moncton, N.B.
Prices are wanted by Mr. P. N. LeBlanc, Bacon street, also description of different kinds of fire extinguishers for use in small factory.

Orillia, Ont.
Messrs. J. R. Eaton & Sons are about to purchase woodworking machinery for the additions recently made to their planing mill.

South Middleton, Ont.
T. H. Collins, Simcoe P.O., is about to purchase a complete sawmill equipment.

CONTRACTS AWARDED

Montreal, Que.
The Harbour Commrs. have awarded to Jas. Shepherd & Sons, Sorel, Que., the contract for supplying oak timber.

Winnipeg, Man.
The Board of Control has awarded to the Whiting Foundry Equipment Company, of Harvey, Ill., a contract for the supply of a 20-ton hand travelling crane.

Regina, Sask.
The city council have awarded the drilling contract in connection with the gas system to the International Drilling Company.

Business Notes

Bancroft, Ont.
A serious fire occurred here recently and the Bancroft Hotel and a number of stores were destroyed. The loss is placed at $75,000.

Cedarville, Ont.
Mr. Archibald McTavish's sawmill has been destroyed by fir. The loss is partly covered by insurance.

Chilliwack, B.C.
The warehouse of Messrs. Denmark & Burton has been destroyed by fire.

Digby, N.S.
The summer hotel "Lour Lodge" was recently destroyed by fire. The loss of $50,000 is partially covered by insurance.

Florenceville, N.B.
The C. P. R. station and freight shed were recently damaged by fire, which also destroyed the warehouse of the McCain Prime Co. Loss $20,000.

Hull, Que.
A disastrous fire caused the total destruction of Messrs. Gilmour & Hughson's sawmill. 7,000,000 ft. of lumber were destroyed. The loss of $500,000 is partly covered by insurance.

Jacquet River, N.B.
The Louison Lumber Co., Ltd., recently suffered a loss by fire.

Montreal, Que.
The partnership between Alarie & David, bricklayers, has been dissolved.

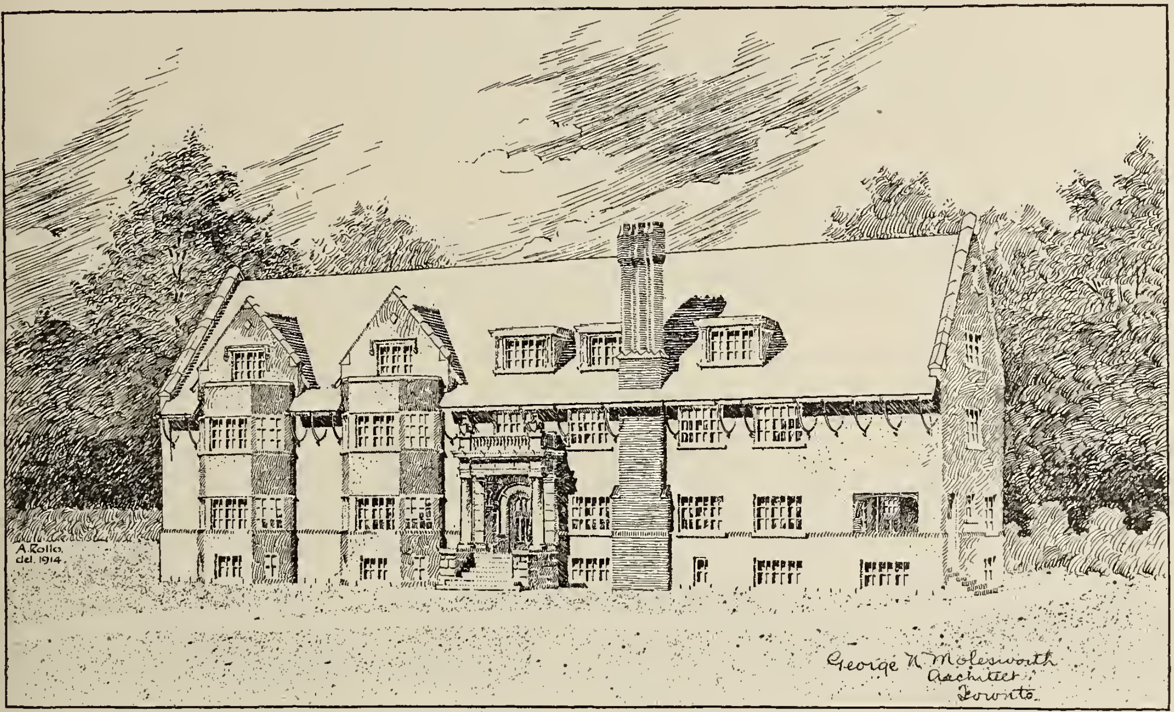
The partnership between Gadoury & Gagnon, masonry contractors, has been dissolved.

The firm of Dugal & Lacombe, builders and contractors, has been reistered.

Grouix & Martin, manufacturers of

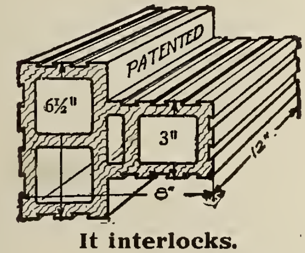
DENISON

Interlocking Hollow Tile


A. Rolla, del. 1914.
George N. Molesworth Architect Toronto

Orphanage for I.O.O.F. **Built like a Thermos Bottle.** Oakville, Ont.

Architect:—Geo. N. Molesworth. Gen. Contractors:—Sutherland Construction Co.



It interlocks.

The one shape and size builds all thicknesses of wall.

Write us for full data.

The One Price Company

Sun Brick Company, Limited

Traders Bank Building

artificial stone, have dissolved partnership.

New River, N.B.
Mr. Thaddeus Groves' mill and machinery have been destoryed by fire.

New Westminster, B.C.
The Salmon River Lumber & Shingle Company's mill, on the B. C. E. Fraser Valley Line, has been burnt. The damage is estimated at $40,000. The premises will be rebuilt in the near future.

Ottawa, Ont.
Letters patent have been issued changing the corporate name of Anglo-Canadian Contractors, Limited, to that of S. Pearson Sons & Partners (Canada), Limited.

Port Dover, Ont.
The works of the Port Dover Brick & Tile Company have been destroyed by fire.

St. John, N.B.
A recent fire at the St. John Milling Co., Rodney Wharf, inflicted a loss of $45,000; $20,000 of which is covered by insurance. The premises will be rebuilt.

Winnipeg, Man.
The Knetchel Furniture Company's factory, on Henry and Lulu streets, has ben destroyed by fire. The damage to the building is placed at $10,000.

New Companies

The St. Lambert & District Building Company, Limited, has been incorporated with a capital of $500,000, with head office at Montreal. The provisional directors are Messrs. Arnold Wainwright, K.C., A. H. Elder, H. F. Glass, and J. H. Wilkie, all of Montreal.

The Peace Valley Light & Power Company, Limited, has been incorporated with a capital of $50,000, with head office at Peace River Crossing, Alta.

Sterling Construction Company has been incorporated with a capital of $40,000, with a capital of $40,000, with head office in Toronto. The provisional directors are E. C. Phipps, N. L. ..eff, C. W. McDiarmid, and J. McD. Burden, all of Toronto.

Harris & Harris, Limited, has been incorporated, with a capital of $50,000, with head office at Toronto, to carry on business as general contractors. The provisional directors are R. R. C. Harris and A. D. Harris, of Toronto, and W. D. Harris, of Ottawa.

Whinstone Macadam Quarries, Limited, has been incorporated with a capital of $200,000, with head office at Vancouver, B.C.

Campbellton Development, Limited, has been incorporated with a capital of $45,000, with head office at Campbellton, N.B., to carry on business as a general land and building company. The provisional directors are G. St. Onge, P. Shannon, and P. Loubert, all of Campbellton, N.B.

Windsor Park Construction Company, Limited, has been incorporated with a capital of $100,000, with head office at Winnipeg, Man. The provisional directors are R. E. Gunn, R. M. Batten, C. A. Wright, K. B. Quantz and H. J. Collins, all of Winnipeg.

Valentine & Guilbault, Limitee, has been incorporated with a capital of $45,000, with head office at Montreal, to carry on business as general contractors and builders. The provisional directors are J. A. Guilbault, H. Valentine, J. B. Gratton and J. E. Gill, all of Montreal.

The County Engineer of Yesterday and To-day

Within the past decade the county engineer has come into prominence, comments Engineering and Contracting, editorially. A few years ago the position of county surveyor, or engineer, went begging. The honor was an empty one. His chief duties consisted of running an occasional land line and selling county maps. To-day in many sections the county engineer is the highest salaried officer of the county and his duties are varied and interesting. The increased importance of the duties of this official is probably due in a large measure to the activity in road construction of recent years.

In England and in some sections of this country this post has always been one of honor and importance—often decending from father to son—and justly so, for as a rule a man to successfully fill this position must possess a combination of tact and engineering and executive ability which is native in few men.

The successful modern county engineer is first of all an executive. His work consists largely of superintending foremen or inspectors, or both. His tact and uniformity of spirit must be exceptional since his dealings with men in many different walks of life are frequent and of importance. Affairs pertaining to the acquisition of right-of-way, the purchase of supplies, the letting of construction contracts, the hiring of labor, the organization and regulation of work, accounting and many similar matters calling for the exercise of judgment pass through his hands.

As an engineer he must be especially familiar with the details of road and bridge building, since a large portion of his work is in connection with these classes of construction. The engineering features connected with road maintenance are becoming important and require his constant personal inspection and judgment as to proper methods and tools to use. In addition to this knowledge he is required to know something of the operation and repair of tools and machinery using horse, gasoline and steam power, the composition and durability of paints and bitumens, methods of accounting, the properties of road materials, the purchase and care of horses and mules and other matters small and large, too numerous to mention.

The writer has in mind an engineer for a typical rural county who receives a salary of about $1,800 per year. He has under his direction three foremen and two inspectors, and has supervision of about 200 miles of road in all stages of improvement. Mules, machinery and equipment of all classes are in his charge, the value of which approximates $20,000. During the course of a year he directs construction work amounting to $150,000. In looking after their work he travels by horse and automobile several thousand miles a year in all kinds of weather. It is a man size job.

Perhaps the most attractive feature of this work to many engineers is its independence. While his term of office is, unfortunately, uncertain, and many undesirable factors of local politics enter, the county engineer is, nevertheless, his own boss. Quite frequently, also, an opportunity is afforded for outside work, which often adds materially to his income. Moreover, if he has leanings toward a farmer's life—as many county engineers have—an opportunity is afforded of carrying on this class of work in addition to his regular duties.

It is desirable that the standard set by county engineers throughout the country be high. Instead of belittling this class of work it behoves engineers in general to realize its advantages and lend their efforts toward the eradication of some of the attendant evils which make it objectionable at the present time.

Painting Over Cement

R. H. Langston

The painting of concrete and cement surfaces is a subject the master painter of the past was not called upon to consider, and I find very little information to be had bearing on the matter.

It is but one of the many new problems that changing conditions of recent years have brought to the master painters of to-day, and there is no question but that it is a matter demanding of the master painter of to-day and of the future a thorough knowledge and investigation. The rapid decrease in the lumber supply and the vast improvements made in cement construction, whereby it has been adapted to every conceivable purpose, all serve to bring it into extensive and increasing use, and I predict the time will come within the life of many of us when on exterior painting, more paint will be applied over concrete or cement surfaces than on wood. It is therefore important that the master painter become educated up to this new class of work.

It must be understood that ordinary linseed oil paints cannot be applied with success directly to cement or concrete surfaces on account of the alkaline lime present in the cement, and which is subject to prolonged formation in the presence of moisture. The action of this alkali is to burn up or destroy the oil, causing rapid fading of colored paints, chalking and scaling off of the material. Therefore, it is necessary, if a linseed oil paint is to be used, that the surface be first thoroughly saturated with a neutralizing wash that will destroy the alkali action. The most approved method is to use a solution of zinc sulphate made by dissolving sulphate of zinc crystals in water in the proportion of three pounds to a gallon of water. A cement surface treated with this wash and allowed to dry can then be painted without danger from alkaline action, and with the assurance that results will be lasting, as if applied to a wood surface.

Many manufacturers now put out cement paints in liquid form, ready for use, in white and all shades, the vehicle used in these paints being alkali-proof and therefore requiring no treatment of the surface before the paint is applied. Paints of this nature are being used extensively on cement and concrete construction with the very best of results and can be obtained at a very reasonable price.—National Builder.

Sale of Quarries, Quarry Plant, Etc.

at Beamsville and Crookston, Ontario

The Trustees of the Estate of the late Honourable William Gibson invite tenders for the purchase of the valuable Quarries situated at Beamsville, 22 miles from Hamilton and 12 miles from St. Catharines, consisting of 94 acres more or less; also at Crookston, 110 miles from Toronto, consisting of 14 acres more or less.

These quarries are those owned by the late Senator Gibson and contain a practically unlimited quantity of the finest limestone and hundreds of thousands of tons of chips suitable for immediate crushing. The Beamsville quarries have a complete tramway system from all parts of it to the G. T. R. Station with valuable franchises, while at Crookston the G. T. R. switch enters the quarry and the C. P. R. is about 500 feet away. Favorable freight rates enable both quarries to compete in the masonry and crushed stone markets of Hamilton, Toronto and Montreal.

Tenders will be received for any or all of the under-mentioned parcels but in the event of parcels 3 or 4 being acquired by tenderers other than the purchasers of the lands the successful tenderers must undertake with the Trustees to remove all the machinery, etc., within three months.

Tenders for parcels 1 and 2 will be considered either on a fixed basis or on a cash payment plus a royalty of so much a cubic yard of stone. The price on a fixed basis will be payable one-third cash, the balance in equal payments at one and two years with interest at six per cent.

Parcel No. 1

Quarry properties at Beamsville owned by deceased with tramway system in connection therewith and being composed of portions of Village lots in Beamsville and of lots in the Township of Clinton in the County of Lincoln, said properties having been conveyed to deceased by deeds registered as Nos. 574 and 304 (Beamsville) 2858, 2509, 2631, 2220, 3558, 2438, 4190, and 5238 (Clinton) and 1259, 1263 and 1268 (Beamsville) with 13 buildings, including office, carpenter and blacksmith shops, engine house, etc. Also three miles of tramway with the existing franchises in connection therewith.

Parcel No. 2

Quarry lands at Crookston containing by admeasurement 14 and 2/100 acres, being composed of part of lot Number Ten in the Ninth Concession of the Township of Huntingdon in the County of Hastings and more particularly described in the conveyance thereof to the said William Gibson dated 21st December, 1896, and registered as No. 5003 (Huntingdon) with all buildings situate thereon.

Parcel No. 3

PLANT AT BEAMSVILLE:

12 hoisting engines with boiler and equipment.
7 power derricks with equipment, masts 65 to 75 ft.
5 pneumatic rock drills.
1 centrifugal pump.
2 Champion road engines.
5 road scrapers.
23 tram cars.
Tools, tool boxes, blocks, pipes, valves, ropes, wires, etc.
16 double drum portable horsepower hoists
4 hand power derricks, masts 18 to 35 feet.
6 blacksmith's forges.
1 sand pump.
1 6 x 16 ft. Blake pattern stone crusher.
3 dump cars.
200 yds. of dressed and partly dressed stone.

Parcel No. 4

PLANT AT CROOKSTON:

2 dynamos.
1 stationary boiler and equipment.
1 single horizontal steam piston pump.
4 derricks.
1 rock drill.
1 hoisting engine with boiler and equipment.
4 horse-driven hoists with equipment.
Pipe, tools, etc., etc.

Detailed inventories may be seen at the office of Mercantile Trust Company of Canada, Limited, in Hamilton or of Messrs. Jennings & Clute, 906-910 Traders Bank Building, Toronto.

A cheque for $500, payable to the Estate of Hon. William Gibson must accompany each tender. The highest or any tender not necessarily accepted.

Tenders should be in the hands of the undersigned not later than August 22nd, 1914.

The Trustees reserve the right to sell privately the whole or any part at any time.

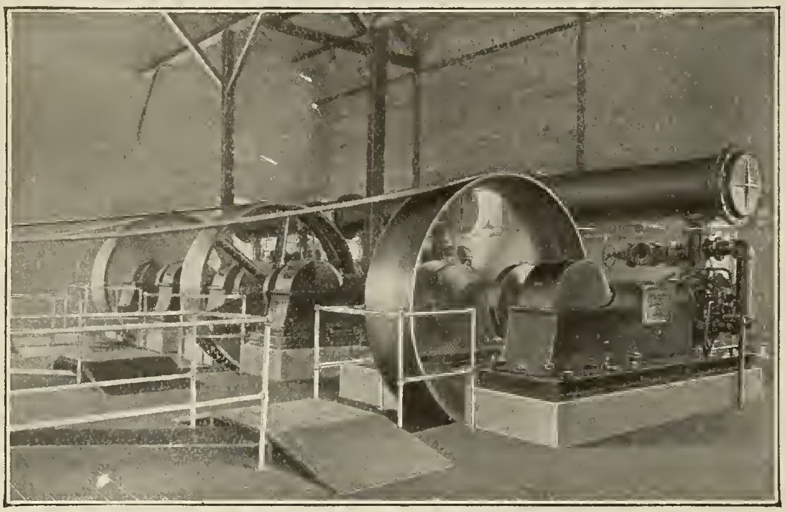
Dated at Hamilton this 20th day of July, 1914.

For the Trustees

Mercantile Trust Company of Canada, Limited

Bank of Hamilton Building, Hamilton, Ont.

"BLAISDELL" AIR COMPRESSORS



DURABILITY, reliability and efficiency have received first consideration in the design of these compressors. Moreover all principal bearing surfaces are provided with a flood lubrication, thus insuring freedom from trouble and resulting in absolute reliability of service.

These points will especially appeal to those running power plants in which continuous service is an absolute essential and to those to whom in most cases, a breakdown would involve serious delay and loss.

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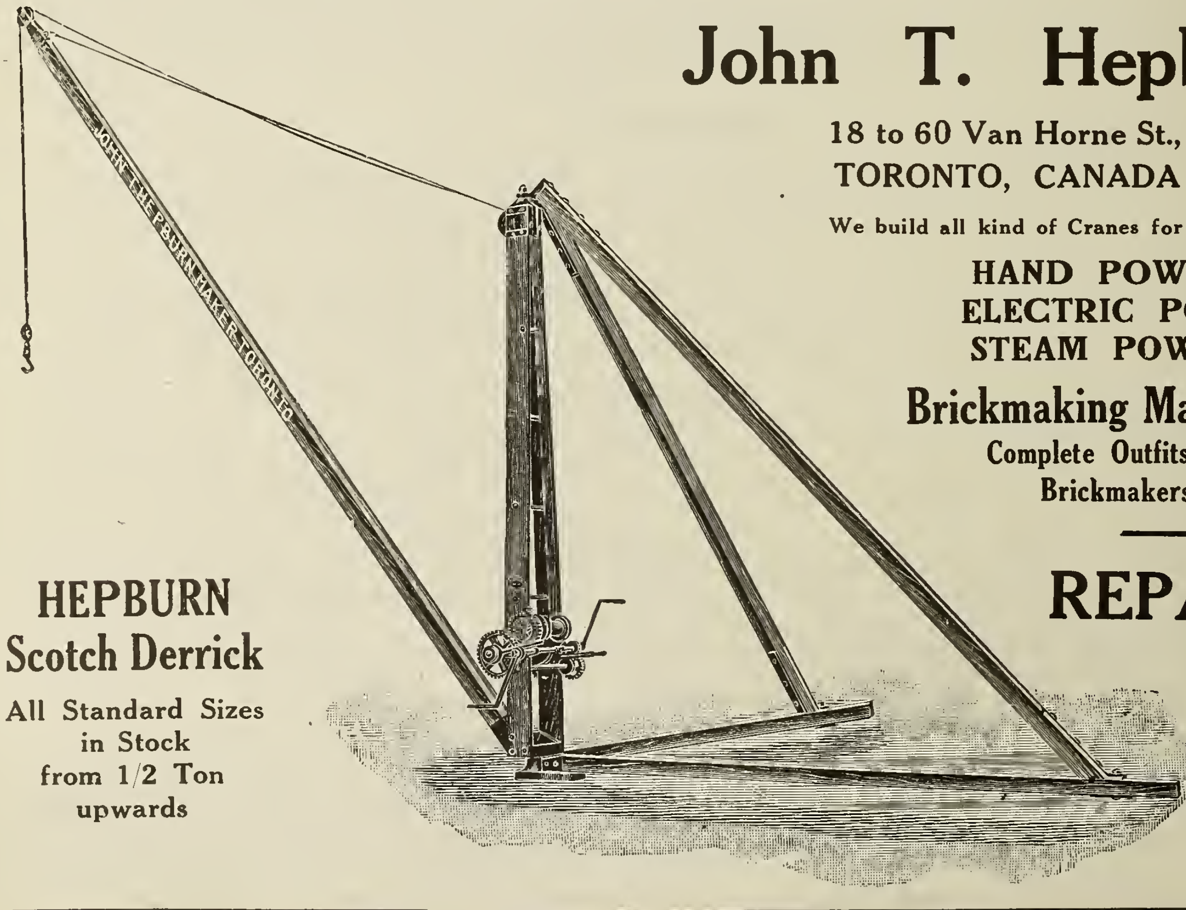
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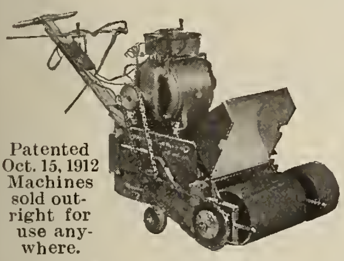

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FOR

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Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1116 pages. Illustrated. Price $1.50.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price $1.00.

School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price $1.00.

Applied Perspective, by William P. P. Longfellow. Published in 1901 by Houghton, Mifflin & Company. 98 pages. Illustrated. Price $1.00.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price $1.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price $2.00

The Theory and Design of Structures, by Ewart S. Andrews. Published in 1913 by Chapman & Hall, Limited, London. 618 pages, well illustrated. Price $2.00.

Foundations of Bridges and Buildings, by Jacoby and Davis. Published in 1914 by McGraw-Hill Book Company. 602 pages. Illustrated. Price $5.00.

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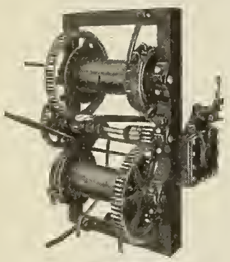
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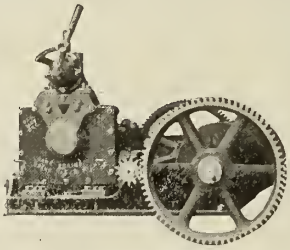
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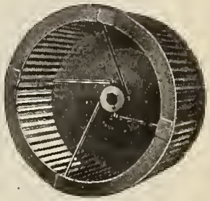
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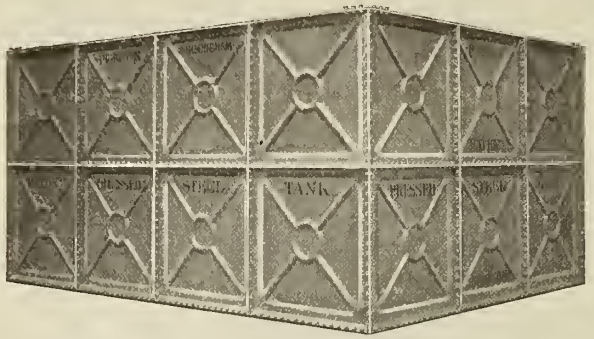

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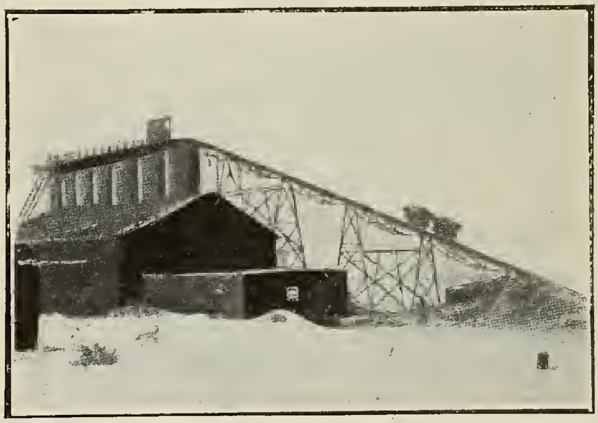

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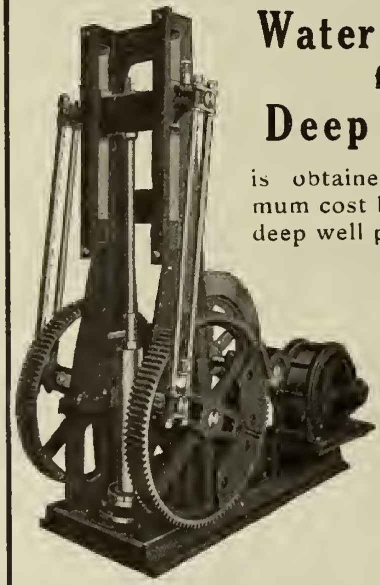

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are strictly **high grade.** Are built to meet all requirements of the building trade.
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Built to meet the requirements of a general purpose two or four horse machine. Constructed so as to be changed from Grader to Drag by removing two bolts. Doing absolutely the highest class of work that any Road Building Machine can do.

The exclusive devices upon this machine include our "Roller Bearings" on all wheels, new worm and screw gear hoisting method and economy of operation, comprising features and advantages that place this machine in a class above any road making machine on the market. Weight 1,000 lbs.

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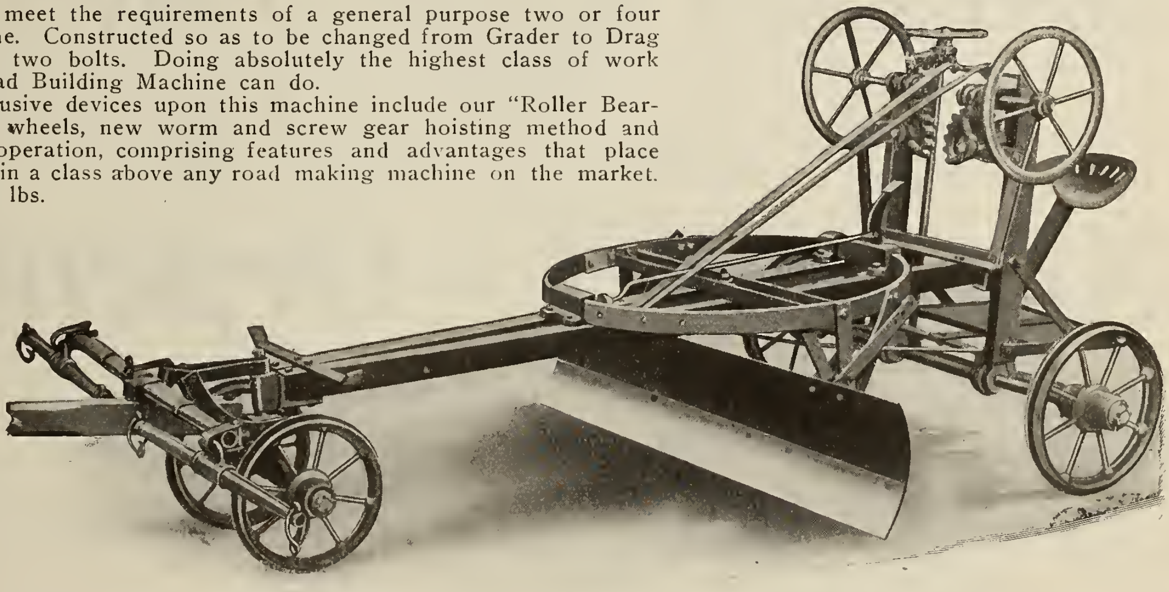

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SEAMLESS STEEL TUBES

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Are Specified by the
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Seamless & Lapwelded Steel Spigot Pipe

from
2" —— *to* —— 60"
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The Right Quality
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at
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Clean threads and smooth enamelled interior allows rapid fishing.

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Let us submit prices and particulars.

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One Municipality Saved $92,000

By advertising their tenders in the " Contract Record."
This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

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Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

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The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

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Contract Record
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This process makes a dependable high grade steel and steel casting, a tough homogeneous material, free from blow-holes, and having a remarkable resistance to fatigue.

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COSTS LESS THAN IRON OR STEEL AND AS DURABLE.

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Estimates furnished promptly. Capacity 18,000 Tons Annually.

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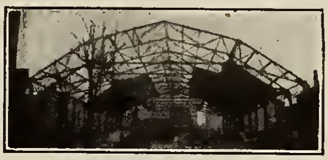

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OUR NEW OFFICE AND WORKS: 1139 SHAW STREET
Main Structural Shop: 130 ft. x 400 ft.
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Capacity: 18,000 Tons Annually

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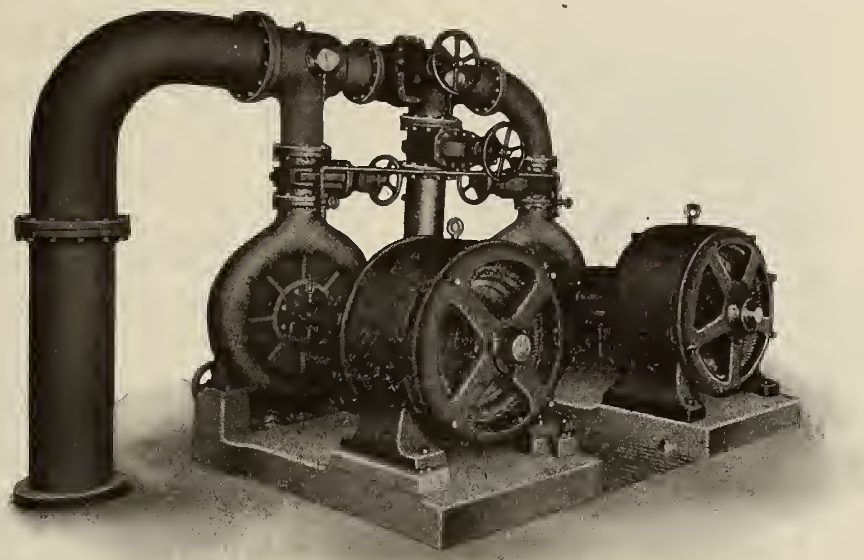

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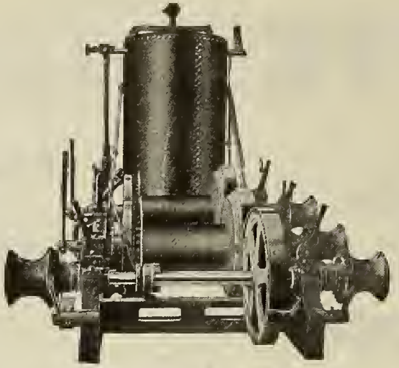

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Sales Agent: MUSSENS LIMITED, MONTREAL, QUE.

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You will find that it is far more economical in cost than ordinary pipe and will answer every possible requirement for which you might buy more expensive material.

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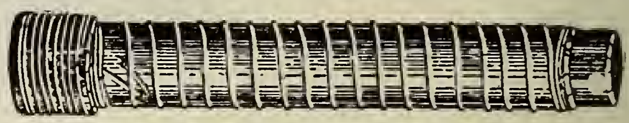

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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With our 9 Branch yards situated as they are we are prepared to guarantee a prompt delivery service of any orders you may favor us with and would ask you to give us a trial in order that we might prove same to you and also prove the excellence of our material.

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Yes and it has other features besides its neatness—it is a "Metallic" Ceiling. The pattern is pleasing and artistic; the sheets are uniform in every detail; the embossing is perfect; it took very little time to lay; and the man who laid it was just a "Handyman."

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Sanitary
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Lifetime Lasting
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Get our prices on "Metallic" Ceilings and Walls—send dimensions. We will send you costs.

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Towers and Tanks for all purposes.

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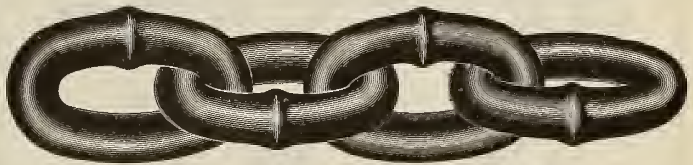

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Proof Test	13,000 lbs.	18,000 lbs.
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Made in Canada × 25% Stronger × Sold by Jobbers

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SINCE MARCH 1st
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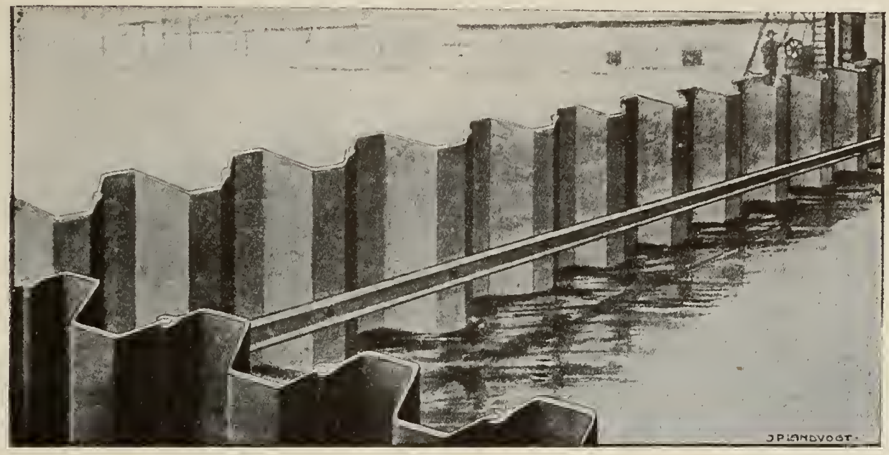

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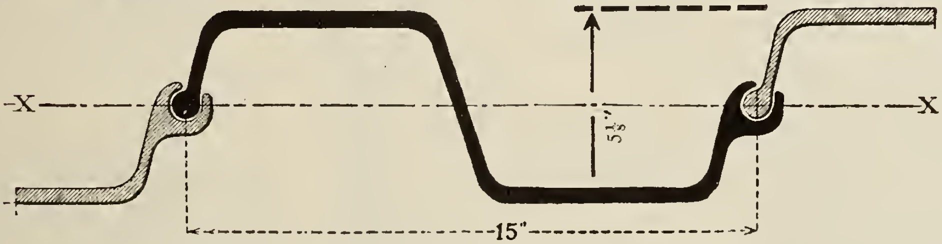

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	Weight per Square Foot of Wall	Weight per lineal Foot of Bar	Section Modulus
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Capital $45,000,000 55,000 Employees

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Steel Pipe for Water or Gas, Seamless, Mild Steel Boiler Tubes, Superheater and Stay Tubes, Boring Tubes; Medium Steel Bars for Concrete Reinforcement

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ANNUAL CAPACITY 36,000 TONS, Shop "A" 18,000 Tons, Shop "B" 6,000 Tons, Shop "C" 12,000 Tons
STEEL BRIDGES AND BUILDINGS

460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

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Our bricks are good and our prices right—write us for quotations.

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The Most COMPLETE LINE OF BUILDERS' DERRICKS MADE

Reinforced Standard 2500 lbs. capacity with geared winch complete $48.00 or for Hand and Power $51.00.

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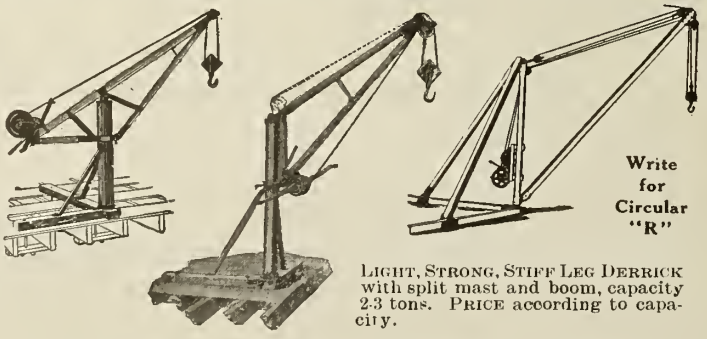

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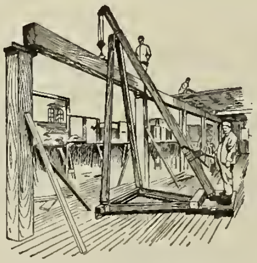

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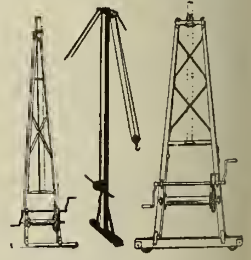

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At these prices you cannot afford to be without one of these Derricks. THEY SAVE TIME, AND THAT MEANS MONEY. CONSULT US BEFORE PLACING YOUR ORDER. SATISFACTION AND PROMPT SHIPMENT GUARANTEED.

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Manufacturers of the well-known

TRIDENT Frost-Proof Water Meters

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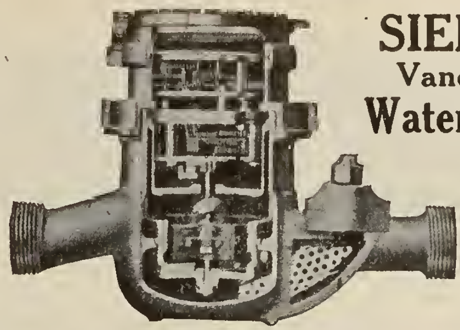

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Simple, solid construction, involving only a few easily interchangeable parts. Best workmanship and accurate adjustment. Large sack-like strainer which has five to ten times the clear cross section of the connecting sockets. This can be taken out without removing meter from pipe. All toothed wheels are cut on special machines, not stamped. Only the best celluloid is used for vane wheels. Meters are fitted with regulating device easily adjusted from outside. Graphite is used for bearings of vane wheel shaft, rendering oiling of bearings unnecessary and is not influenced by water containing salts or acids. Frost proof device.

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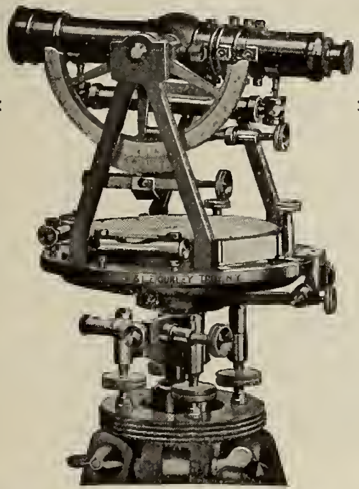

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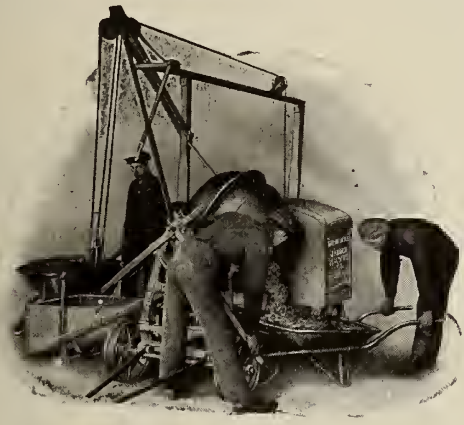

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Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $30; sand-lime brick, $8.60, King Edward Siding; $7.50 at the mill; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-In., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge

Steel channels and beams, angles and plates—$4.

$2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 64c per gal. of 9 lbs.

Raw linseed oil—in bbls., 61c per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 70c.

MONTREAL PRICES

CEMENT, LIME AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $24, red $24, buff $25, white $47, plain pressed $12 per thousand, all f.o.b. Montreal. Quotations f.o.b. Toronto:—White $52.50, buff $30, grey $27.50, plain pressed $17.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15c basis per pound; British manilla, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 66c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car-load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 lbs.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

(Continued on page 106)

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103-107 Board of Trade Building :: MONTREAL

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from p. 104.)

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; bandsawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.85 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Harner Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $8.85 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.75; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$12.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 85c per gal. of 9 lbs.

Raw linseed oil—in bbls, 83c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

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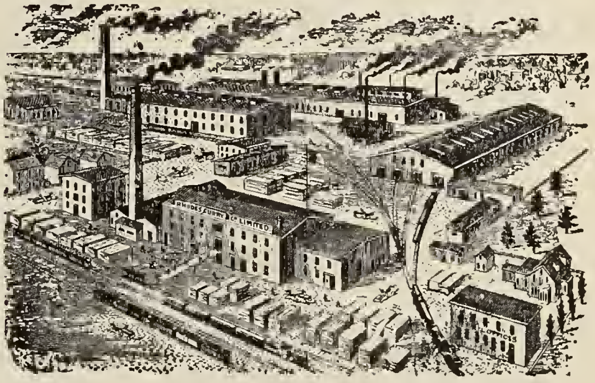

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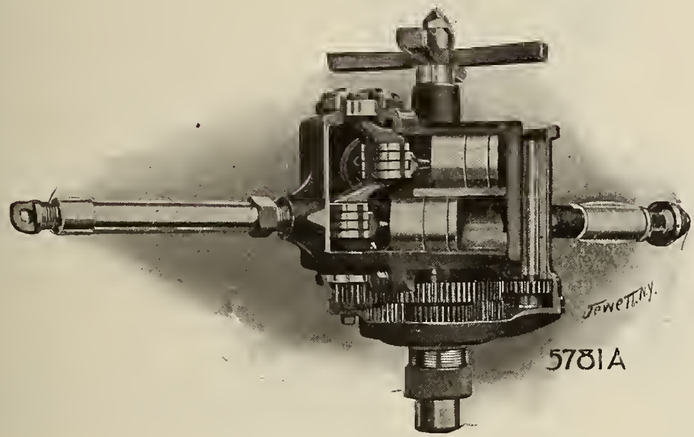

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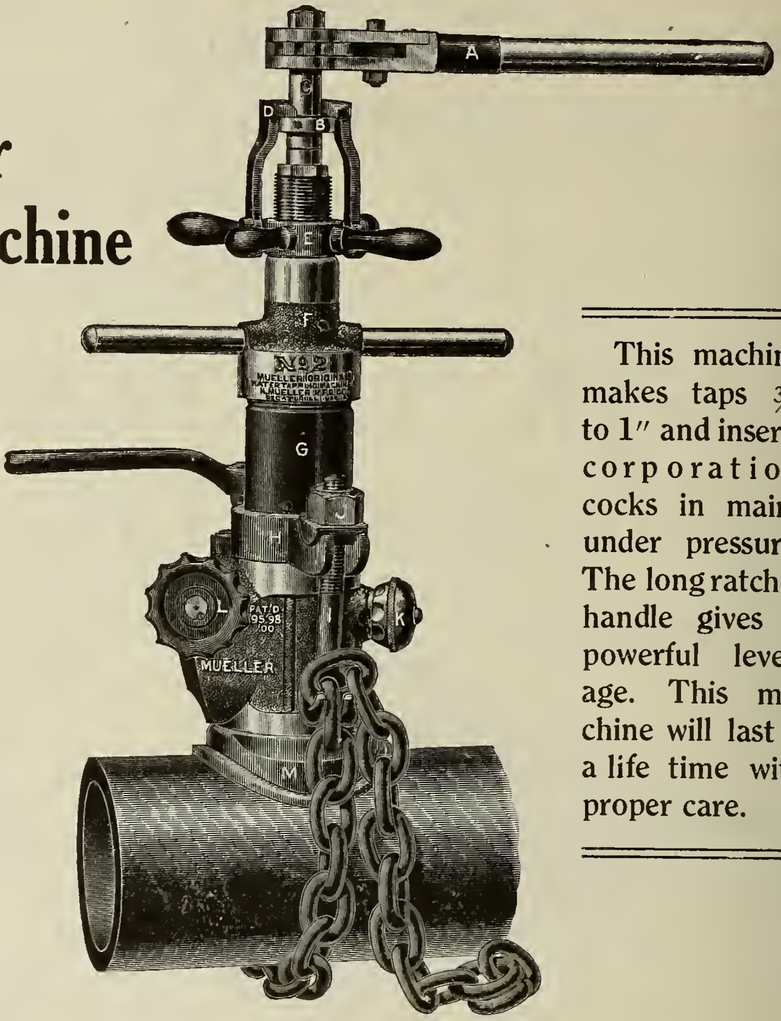
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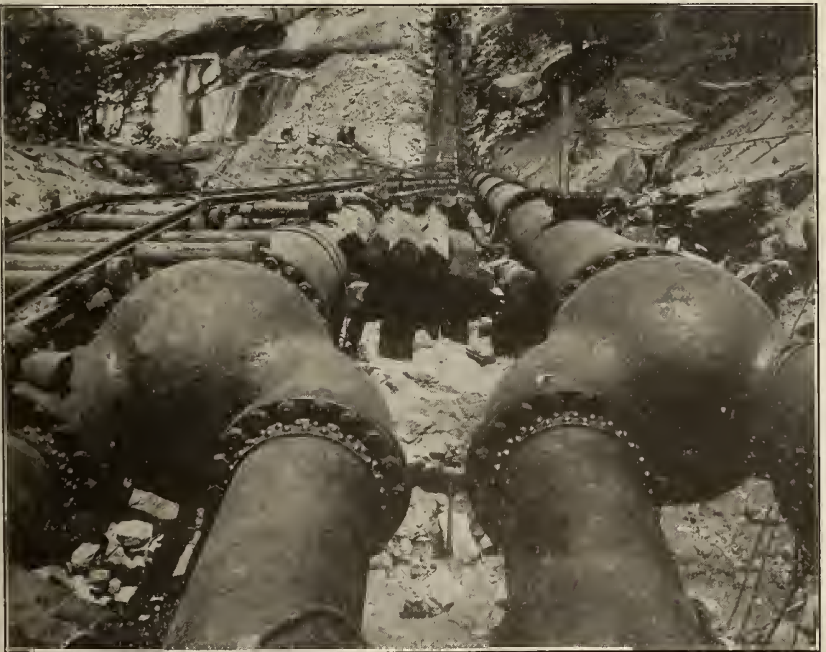

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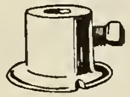


Fig. 1

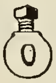


Fig. 2

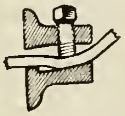


Fig. 3

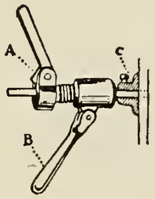


Fig. 4

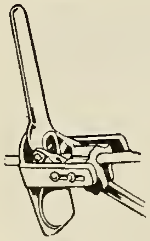
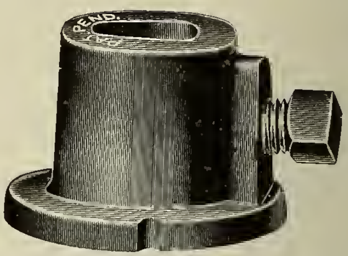


Fig. 5

Use UNIVERSAL CLAMPS
to convert any round rod into a bolt



Long bolts—removable bolts—bolts extending through timber and poured concrete—these are best for form work.

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Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section. showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screw is tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

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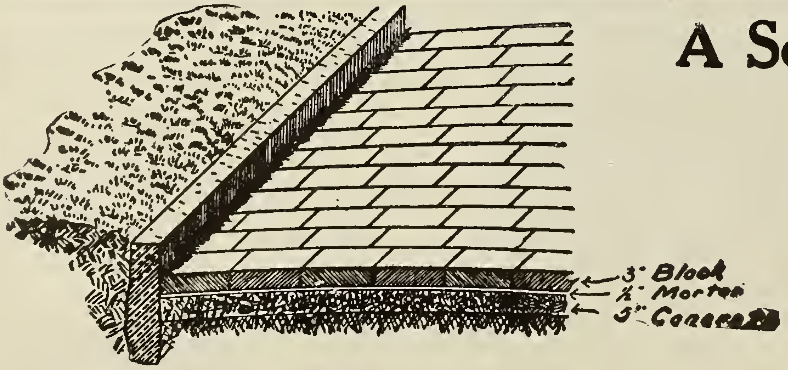

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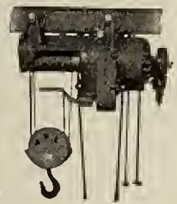

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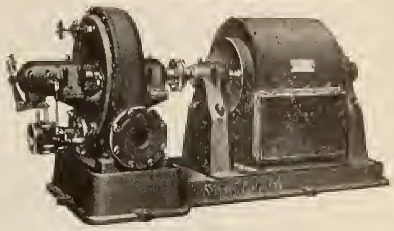

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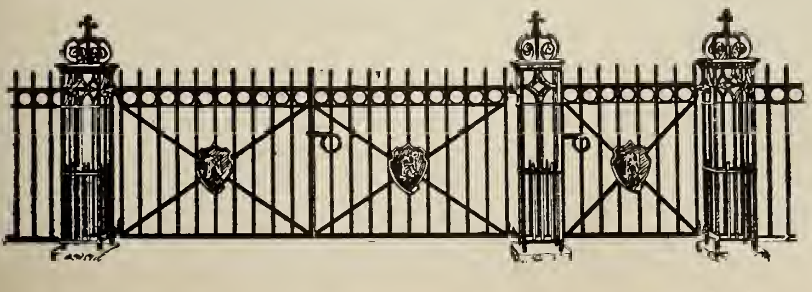

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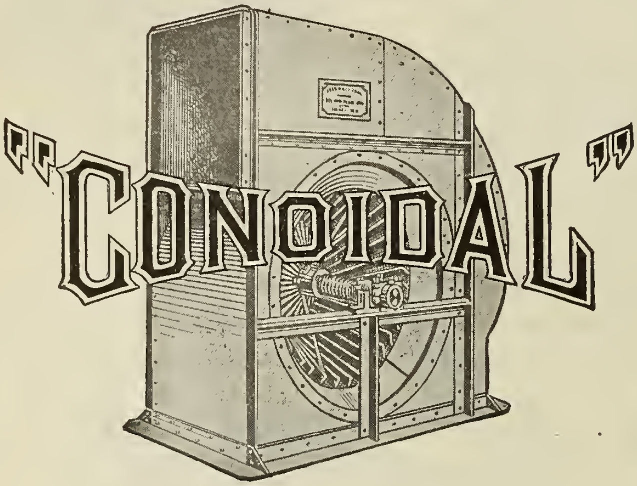

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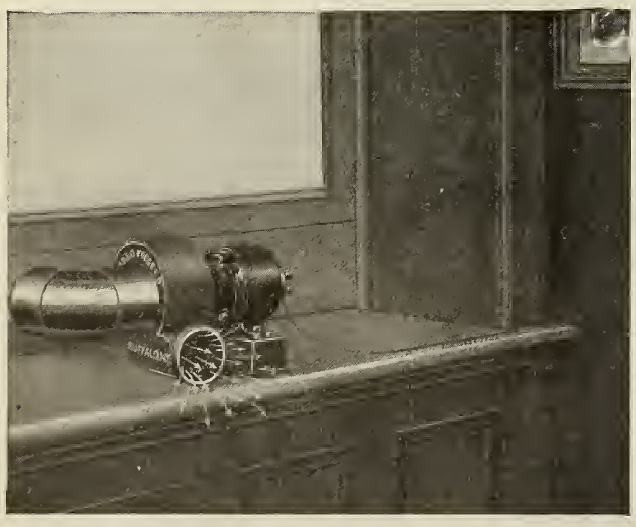

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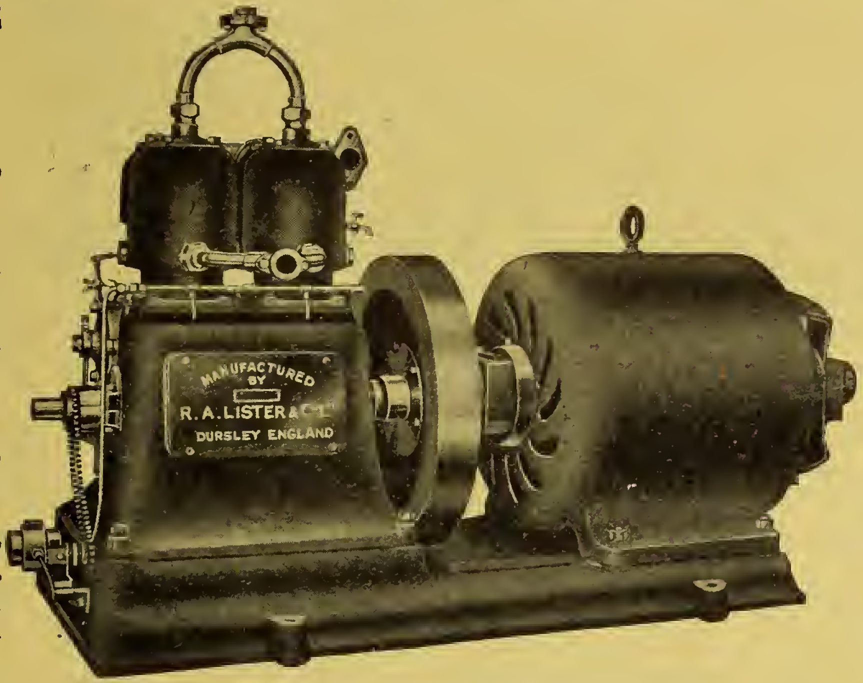

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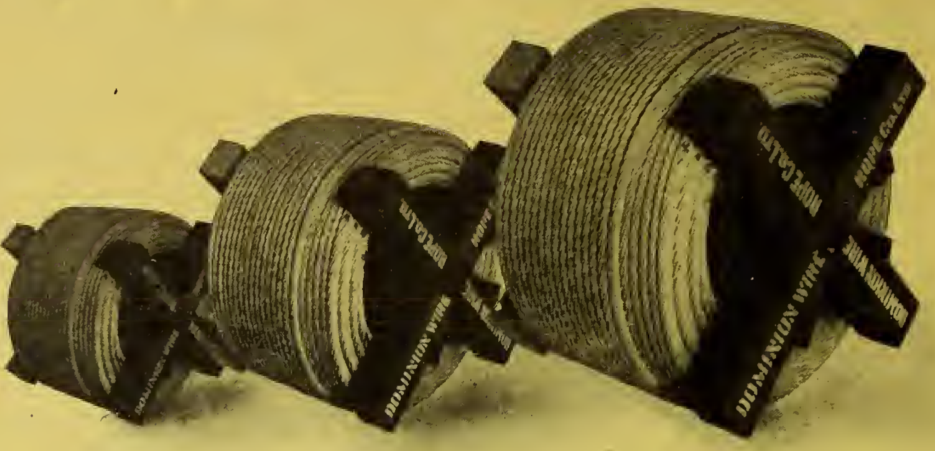

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Vol. 28 Toronto, August 19, 1914 No. 33

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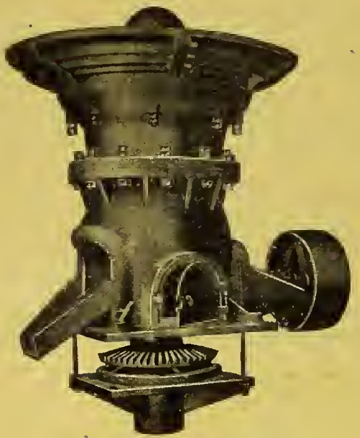

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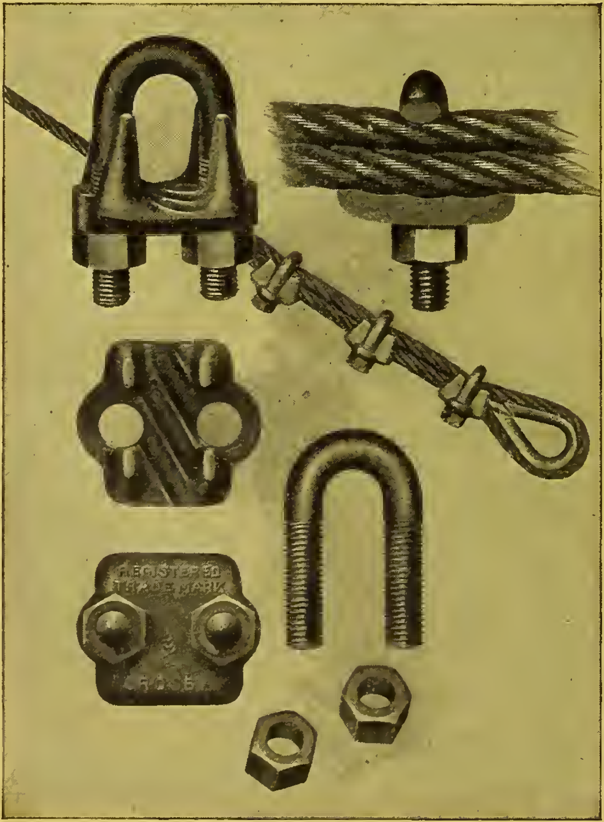

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American Hoist & Derrick Co.

ST. PAUL, MINN.

SOLD BY—General Supply Co., of Canada, Ltd. Montreal, Ottawa, Toronto, Canada. Stuart Machinery Co., Winnipeg, Man. Vancouver Machinery Depot Ltd., Vancouver, B.C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.

Grand Avenue Viaduct, Milwaukee, Wis. Monolithic Concrete Construction, Spans—8 of 145 feet each. Length, 2088 ft. Width 67 ft. Height 80 ft.

Concrete Bridges

Artistic - Economical - Durable

The important requirements of any material for bridge construction are fully and economically met by concrete.

Concrete may be moulded into any form, therefore is particularly adaptable to bridges necessitating special construction. Its great strength, economy and permanence combined with its almost unlimited possibilities in obtaining artistic effects, gives concrete a preference not attained in any other material.

The strength of concrete increases with age, which gives it great reserve strength and reliability. Its durability is best evidenced by structures that have been in use in different parts of the world for periods extending over a great number of years.

The weight of a concrete bridge is so large in comparison with the live loads to be supported, that vibration and deflection are almost imperceptible. The use of concrete for bridges not only means economy and convenience to the Engineer and Contractor, but permits practically all of the cost to be returned to the ratepayers for cement, sand, stone or gravel, lumber, teams, and labor.

The total cost of a bridge can only be determined by adding to the first cost, the cost of maintenance during the life of the bridge. Concrete requires a minimum upkeep, thus making the first cost practically the only cost.

We have complete information about concrete bridges of all sizes, including details as to location, cost, engineers, contractors, etc. This information may be had for the asking. Address

Information Department

Canada Cement Company

Limited

884 Herald Building, Montreal

The Smith-Chicago Record Paver

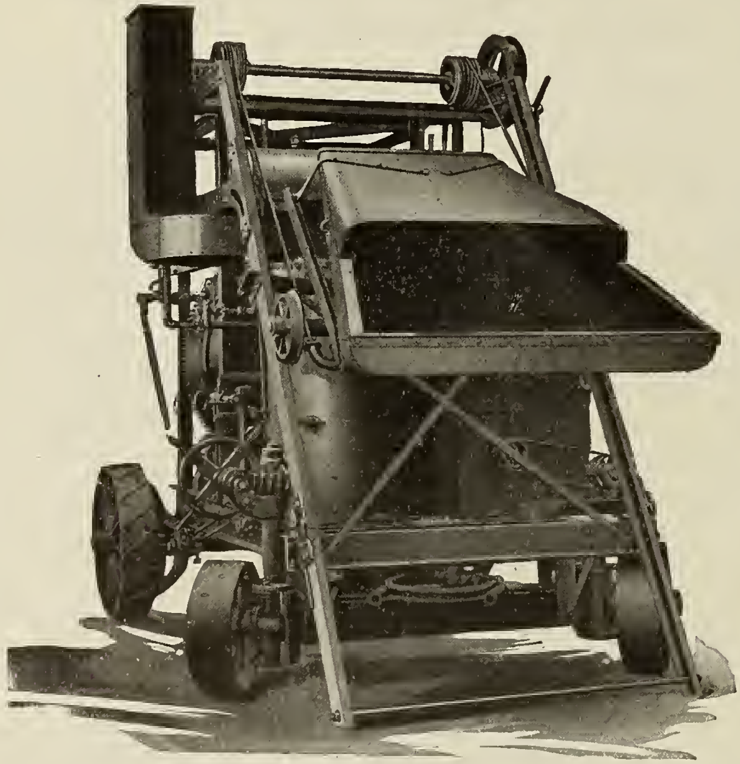
The Record Paver deserves a place on that concrete road job of yours. You will need it to get all there is out of the work. Take a look at this Paver. Remember that concrete road work is in its infancy. Developments are rapid; and the wisest ones have to "hump" to keep up with the times. Here are some of the more prominent features that you must not miss.

Distributing Chute—Any length up to twelve feet. Furnished with tip-up chutes three feet apart.

Loading Skip—5½ feet wide across back, to take two wheelbarrows simultaneously **Only six inches high** at back, to permit easy loading. Non-pivoted type, to reduce power consumed and minimize strain upon the hoisting shaft, boxes and loader frame.

Traction—Forward and reverse drive to both wheels. Clutches work with finger pressure. All levers and steering wheel banked for easy operation by one man. Steering wheel can be disconnected for haulage by team.

Wheels—Front and rear wheels **track.** Front wheels 24 inches diameter, with 12 spokes and 8-inch tires, ½ in. thick. Rear wheels, 36 inches diameter, with 32 spokes and 8-inch tires, ½-inch thick. Removable creepers furnished.



Axles—Rear axle made of two 7-inch channels riveted over steel skeins. Front axle made of two 7-inch channels, riveted over steel steering knuckles.

Power Plant—Ten (10) H. P. vertical boilers with eight (8) H. P. engine.

Send for Catalog No. 71-V describing the—

Smith-Chicago Record Paver

Furnished and Guaranteed with 12 ft. Swivel Chute. See Our Special Guarantee on Opposite Page.

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Our Guarantee
To the Paving Contractor

A good many contractors think that guarantees are mostly "bunk;" and so they are, unless made definite and plain so that the buyer knows just what is guaranteed. We guarantee our No. 509 Record Paver to do certain things, so that any user can tell immediately, beyond room for argument, whether he is getting what he bought. Here's the guarantee, which we will embody in the order for any man who wants it.

We guarantee the **Record Paver** as follows :

Output—On a twenty-foot, one-course road, with material properly placed, with a gang of 18 men it will lay not less than 100 square yards of six-inch concrete per hour.

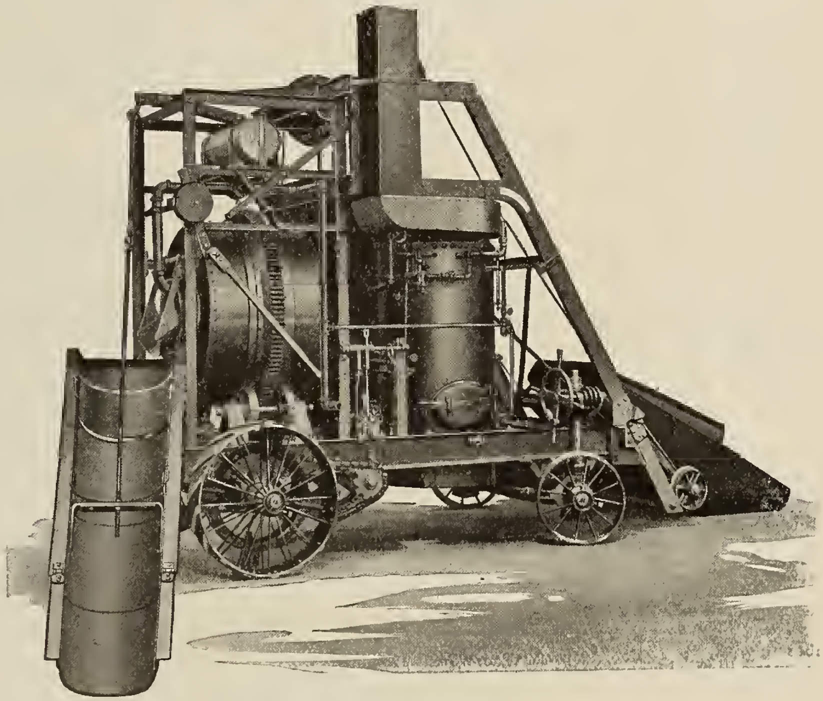
Driving Mechanism—The traction mechanism will drive this mixer over a 6″ x 6″ timber, or up any hill that is practicable for automobile traffic.

Loading Skip—5½′ across the back—wide enough to take two wheelbarrows at once. It dumps the batch **clean** without pounding the bottom.

Wheels and Axles—The wheels track ; and the front wheels have a splendid cramp. The axles will stand the severest test. Bump the machine over some big 6″ x 6″ timbers. We guarantee that the wheels and axles will stand the strain.

Chute—The distributing chute will handle any mixture suitable for road work, to the satisfaction of any competent engineer. It is **guaranteed** to pass inspection, working. Remember, we **guarantee** it, as above, up to twelve feet in length.

Conditions—The guarantee is subject to just one condition. If you can't get the guaranteed results from the machine, give us a chance and we'll do it. If we can't, we'll take it back and refund your money.



Send for Catalog 71-V illustrating the

Smith-Chicago
Record Paver
(No. 509)

The Most Solid and Substantial of all Paving Machines.

Mussens Limited

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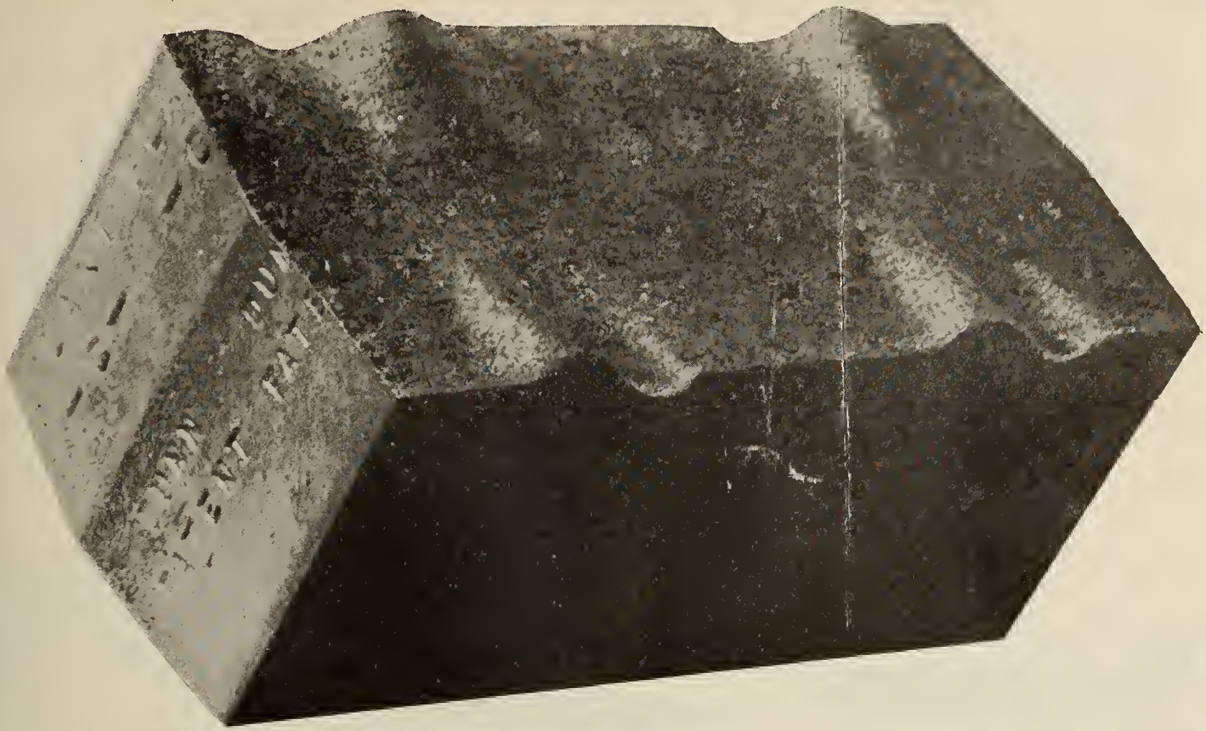

Observe the Wire-Cut-Lugs

THIS is a photographic reproduction of a Bessemer Wire-Cut-Lug Block. Note the Dunn patented lugs, the evenness of the wire cutting and the smooth, wearing surface—four inches of tough, durable, hard wearing surface.

BESSEMER WIRE-CUT-LUG BLOCK

Patented lugs allow cement grouting to flow easily between the block and thus make a perfect, lasting union. The ideal road paving for motor-trucks, heavy wagons and automobiles. Lowest traction resistance. Easily kept clean. Low maintenance cost. High quality that never varies—always uniform, reliable and safe. Bessemer Paving Block outlast all other material, and forms easily the cheapest paving when efficiency and length of service are considered.

Every carload factory-tested. For a permanent, durable, always-satisfactory road specify Bessemer Wire-Cut-Lug Block.

Send for free illustrated catalogue. Full of interesting facts and information.

Bessemer Limestone Company

Youngstown, Ohio

Canadian Agents G. W. ESSERY, 47 Yonge Street, Arcade Building, Toronto, Ontario
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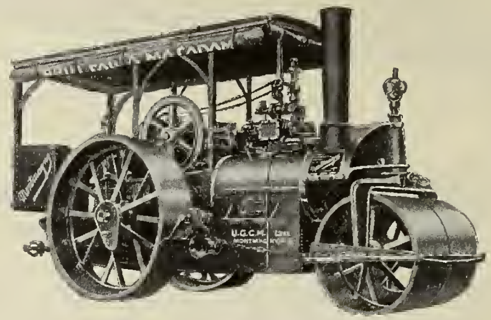
"Montmagny" Modern Road Builders

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



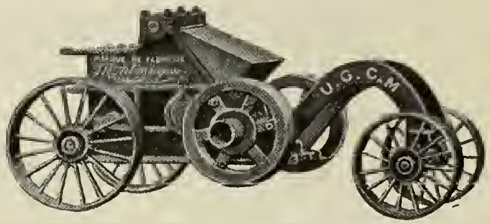
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"



"Montmagny" Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

"Montmagny" Portable Steel Bin.

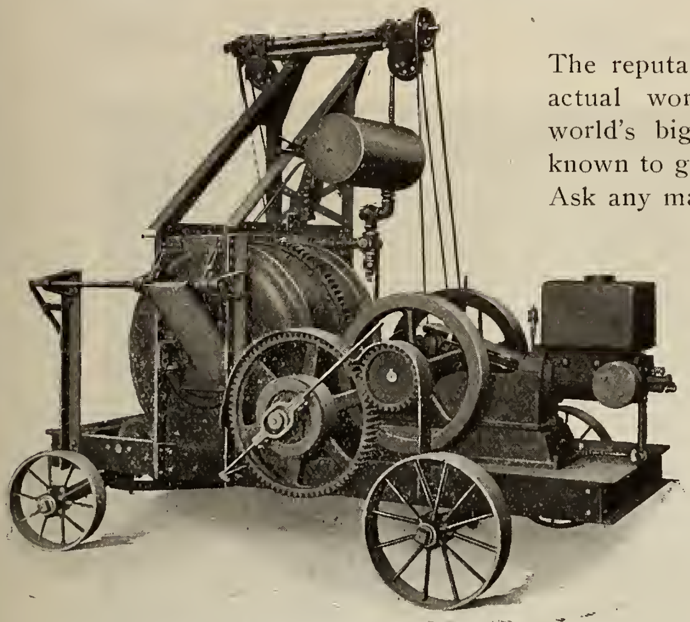
Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

Quebec MONTMAGNY, P.Q., Can. Montreal

"Most Mixing - Least Fixing"



M-C Rail-Track Mixer with Elevated Side Loader, operated by Gasoline Engine

The reputation of the M-C Rail Track Line is based upon actual work performed. Contractors who construct the world's biggest buildings insist upon machines which are known to give "most mixing" with "least fixing."

Ask any man who owns an

M-C Rail-Track Mixer

what he thinks of it. He best can tell you what the machine will do. Building mixers are ¼, 1/3, ½, ¾ and 1 cu. yd. of concrete per batch in size.

Power: Steam, Gasoline or Electric Motor.

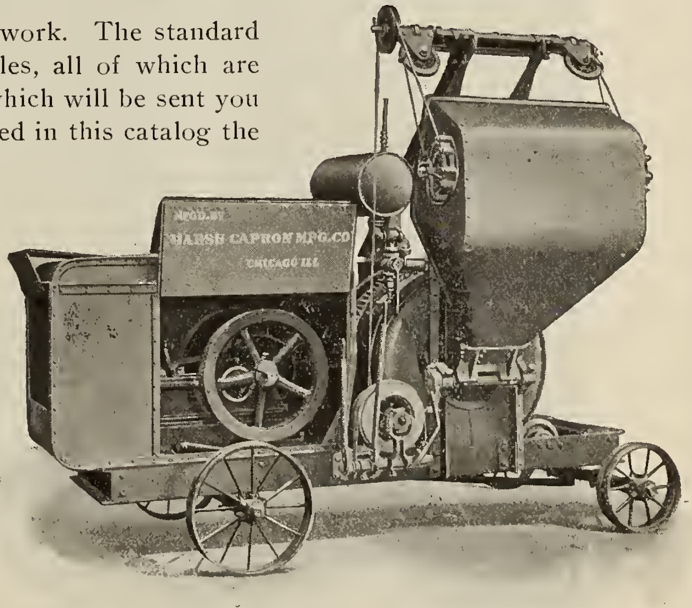
M-C RAIL-TRACK MIXERS

are built for every kind of cement construction work. The standard line for building contractors includes many styles, all of which are illustrated in a beautiful new catalog, a copy of which will be sent you post paid on request. There is also fully described in this catalog the

M-C RAIL-TRACK PAVER

which is the wonder of all who have seen it at work. This paving mixer has all the good features of the M-C standard line, to which are added traction features which include shock absorbers when travelling, two speeds ahead and one reverse, extra large strong wheels and strong brakes. It runs like an auto truck or a traction engine, up hill or down, safely, without the need of horses. The machine is easily controlled by one man.

Be sure to send for the new catalog



M-C Rail-Track Mixer showing Steel House Provided for Gasoline Engine and Elevated Side Loader

CANADIAN FAIRBANKS-MORSE CO., Ltd.

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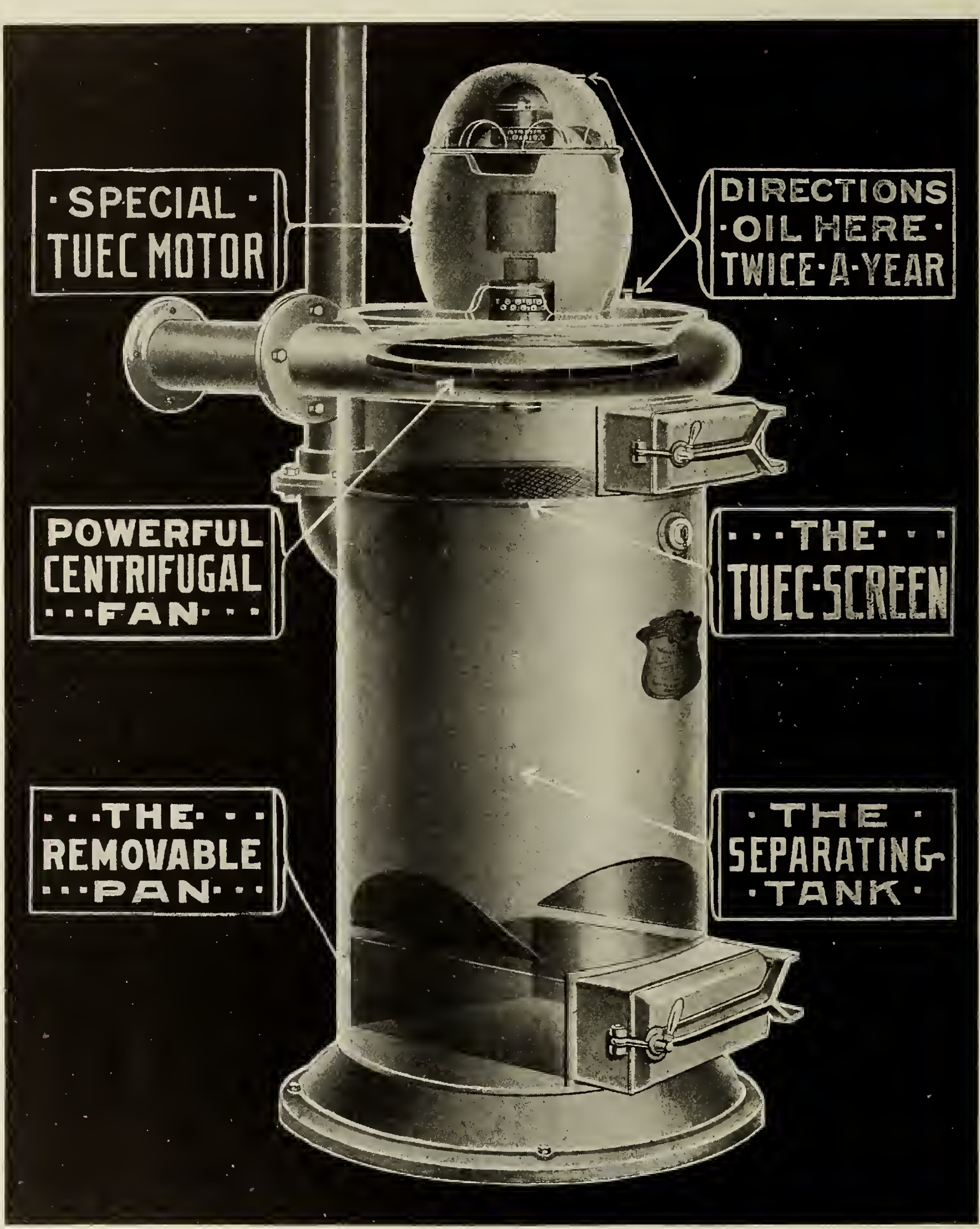
Manufactured by

Marsh-Capron Mfg. Company

465 Old Colony Bldg., CHICAGO

Tuec Stationary Vacuum Cleaners

Simplicity — Economy — Durability



See Tuec Machine demonstrated at Machinery Hall, Canadian National Exhibition, Toronto, August 29—September 12.

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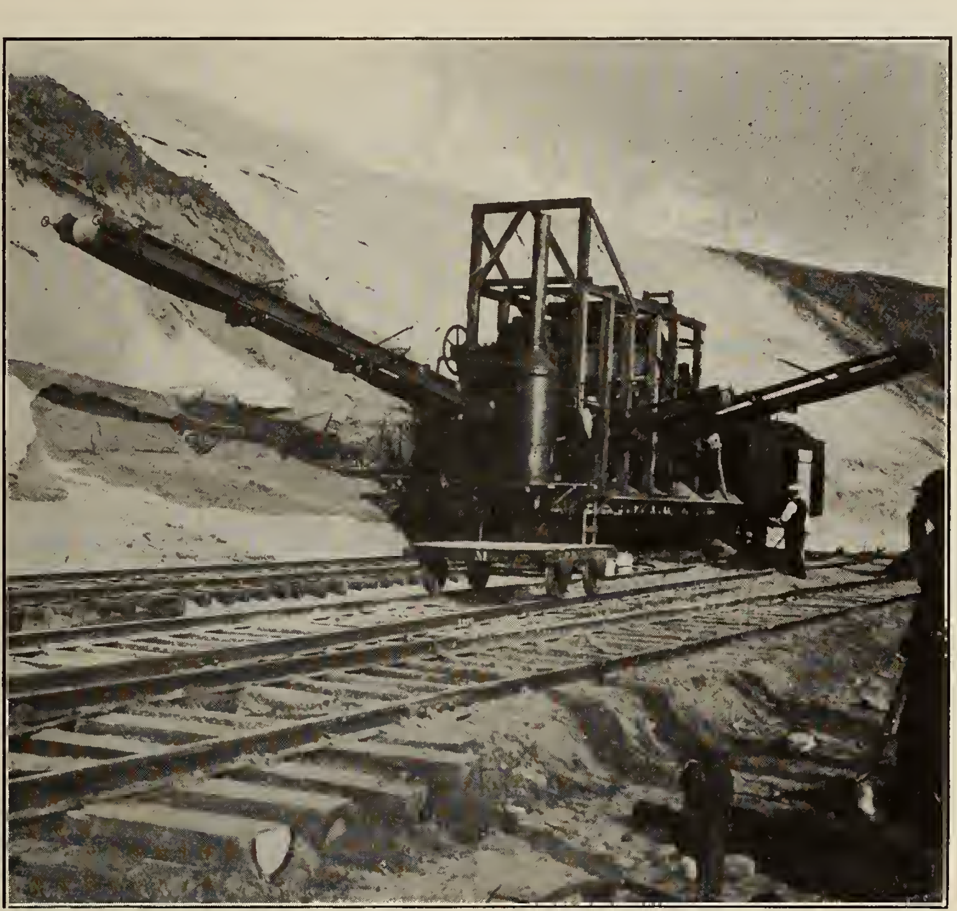
Reduce Production Cost of your Sand and Gravel



Portable Gravel Screening Plant, capacities 300 to 1,000 cubic yards per day. Can be shipped on its own wheels.

Realizing the need of a gravel screening plant of sufficient capacity to meet the demands of modern methods and yet be portable so that the whole plant would be self-contained, and able to be shipped from point to point, the Rock & Power Machinery, Limited, have designed and placed on the market such an outfit.

A decided advantage is due to the fact that the plant follows the face of the gravel pit and steam shovel or clam shell excavator loads directly into the hopper of the machine. In this way an extra handling of the material is avoided with a large saving in the cost of operation over the plan of a stationary plant where the working face is constantly moving away from the screen.

The illustration shows a plant designed to make three products, sand, pea gravel and coarse gravel, and the three products are simultaneously loaded into three railroad cars, two of which are on parallel tracks, and one on the same track with the plant.

Rock & Power Machinery

Limited

12 King Street East, Toronto.

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(Continued on Page 14)

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Meters, Motors & Transformers

in Toronto & Winnipeg have recently been

LARGELY INCREASED

so that the suspension of Atlantic traffic will not cause our friends any inconvenience.

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704 Unity Bldg.
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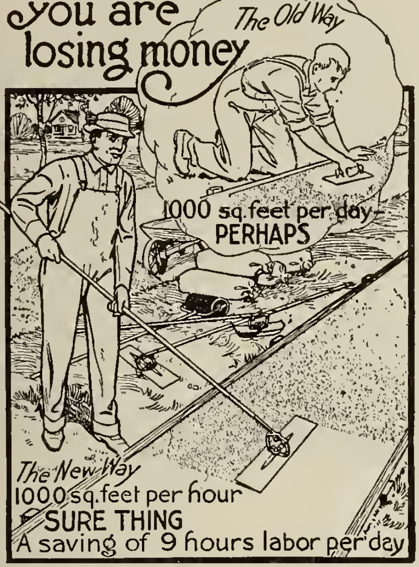
Farmer's Advocate Bldg.
Winnipeg

If you are not using

"ABRAM" TOOLS

It is plain to be seen you are losing money



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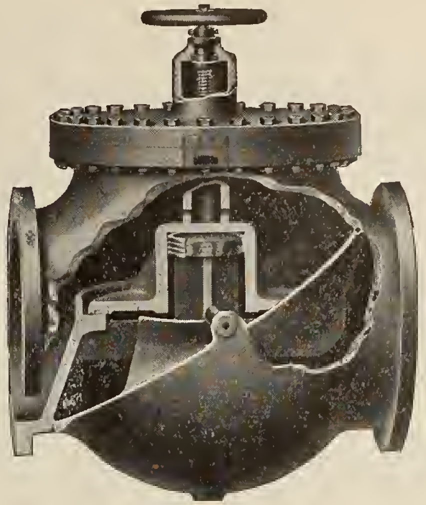
Windsor, Ontario



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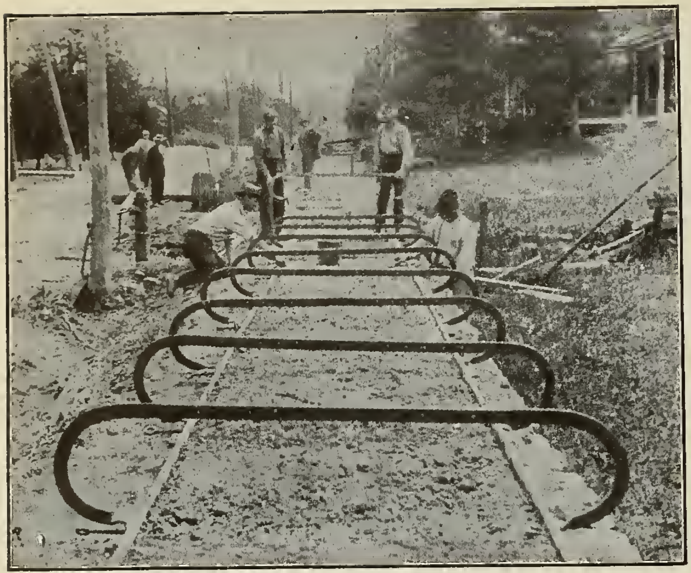

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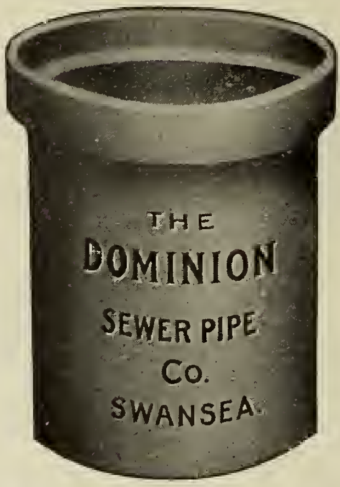
SEWER PIPES

True to Size.
Impervious to Water.

Sizes manufactured and always in stock 4 in. to 24 in.

Ask for Price List and Discounts.



also

Chimney Tops
Flue Linings
Wall Coping
Culvert Pipe
Inverts

Telephone (Toronto Connection)
Park 1809

The Dominion Sewer Pipe Co.
(The Independent Co.) Limited
SWANSEA (near Toronto)

The Thew Steam Shovel Will Save You Time, Trouble and Money

Type O Thew on Road Grading

The use of a Thew Automatic Steam Shovel will effect an immense saving in labor.

The output is limited only by the facilities provided to cart it away.

The Type O Thew shown in the cut loaded 1,965 cu. yds. in 7 ten-hour days.

Another Type O Thew in a 6 ft. cut averaged 578 cu. yds. during the month of April.

Another Type O Thew in a gravel pit loaded 5,182 cu. yds. in 7½ ten-hour days—an average of 76 cu. yds. per hour.

Another Type O in a 15-inch cut averaged 314 lineal feet, amounting to 292 cu. yds. per 9-hour day for 23 days.

Another Type O in a 10-inch cut excavated 1,788 lineal feet in 6 ten-hour days—amounting to 1,455 cu. yds.—an average of 242 cu. yds. per 10-hour day.

USE A THEW—IT PAYS.

Write for Catalogue and Full Information.

The Thew Automatic Shovel Company, - Lorain, Ohio

Sewer Pipes

High Grade Salt Glazed Vitrified Sewer Pipes and connections are a specialty with us. We also manufacture culvert pipes, inverts, flue linings, stove linings, fire bricks, locomotive blocks, gulley traps, range bricks, cupola linings, wall coping and all kinds of vitrified and fire clay goods. Prompt shipments on all goods.

Vitrified Hollow Building Blocks

Standard Clay Products Limited

THREE SEWER PIPE FACTORIES : **St. Johns, P. Q., and New Glasgow, N. S.**

ALSO FIRE CLAY FACTORY AT ST. JOHNS, P. Q.

Mimico Sewer Pipe

VITRIFIED AND SALT-GLAZED

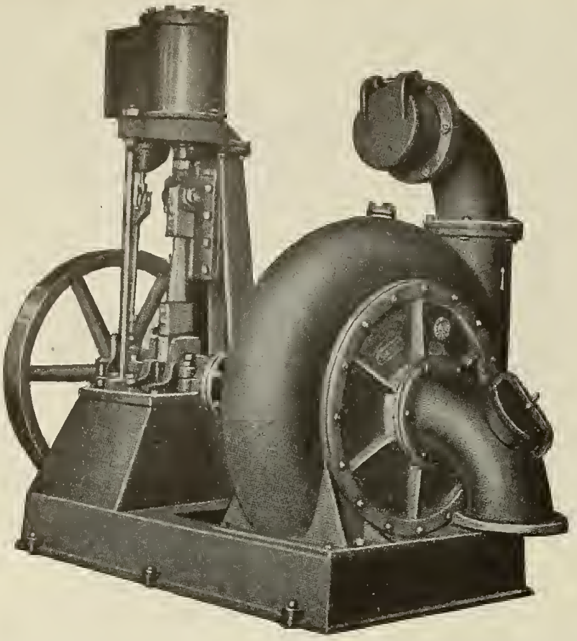
Quality

Service

ROUND PIPE AND SQUARE DEALINGS

The Ontario Sewer Pipe Company, Limited

MIMICO, - ONT.



Contractors Sand and Dredging Pumps

Complete Hydraulic Dredging Machinery

Centrifugal and Turbine Pumps for Every Service

MORRIS MACHINE WORKS - Baldwinsville, N.Y.

Canadian Sales Agents—

Storey Pump and Equipment Co., Ltd., Toronto, Montreal

Crushed Stone ....Cu. Yds

For Concrete or Road Construction

Portland Cement ....Bbls.

Trap Rock—Granite ....Cu. Yds.

G.T.R., C.P.R. and Team Delivery

Let us quote on your requirements.

Name..

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Delivery Required at..

Rogers Supply Company, Limited

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Contract Record

New Toronto Factory of National Cash Register Co.

HEATING CONTRACTORS FOR THAT WELL KNOWN FIRM

The Nobis Engineering Co.

ENGINEERS AND CONTRACTORS

333 King Street West, Toronto, Ont.

GET THE NOBIS HABITS AROUND YOUR POWER PLANTS

APOLLO KEYSTONE GALVANIZED SHEETS

COPPER BEARING WEATHER WEARING RUST RESISTING

The best sheets on the market for
Roofing, Siding, Guttering, Cornices, Pipe, etc.
and for all exposed Sheet Metal Work.

UNITED STATES STEEL PRODUCTS COMPANY

NEW YORK, U.S.A. Branch Offices, WINNIPEG AND VANCOUVER

SELLING AGENTS FOR EASTERN CANADA:

B. & S. H. THOMPSON & CO. LIMITED

Transportation Building
MONTREAL

Traders Bank Building
TORONTO

Sewers and Culverts

properly built of properly made

Reinforced Concrete Pipe

LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

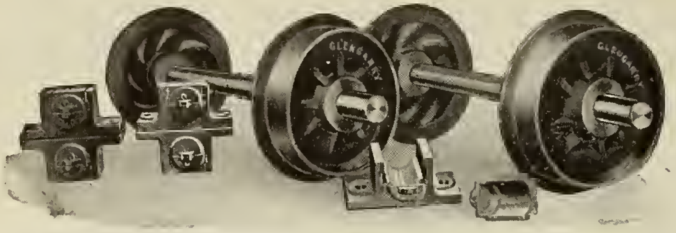
STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application

Dominion Concrete Company Ltd.

Kemptville, Ontario



Cut showing Wheel Setts complete with Oil Tray Journal Boxings. All styles Journal Boxings supplied to suit customer.

GLENGARRY

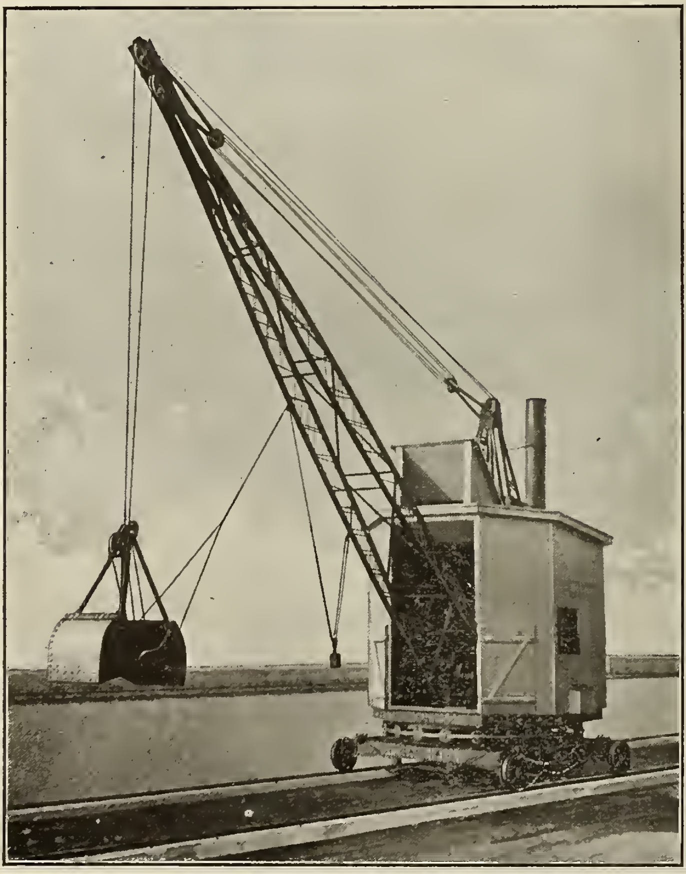
WHEELS, AXLES AND JOURNAL BOXINGS COMPLETE

We can supply all kinds of equipment of this class.

When You Buy "Glengarry" Goods You Will Be Pleased

We have a large and growing business in the manufacture and supplying of wheels and axles with various styles journal boxings for sand, gravel, lime and rock quarries. Also lumber mills, mines and industrial plants. Special attention paid to customers enquiries enabling them to select the proper goods required, and get the benefit of our experience. Designing of special goods a feature. Write us for quotations. Wheels made with chilled tread and flange, or ordinary iron. Axles of best steel. Various styles of journal boxings.

The Schell Foundry and Machine Company, Limited
ALEXANDRIA - - - - ONTARIO



For Economical Loose Material Unloading
use a

BEATTY

Travelling and Revolving Derrick

Fitted with a
"FAIVRETTE" TYPE "C"
Clamshell

Our 1914 catalogue illustrates and describes BEATTY HOISTS. Excavating and Handling Equipment for use on land and water.

M. BEATTY & SONS

Limited
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Established 1862

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A. R. Williams Machinery Company, Winnipeg, Man.

KAHN SYSTEM
OF REINFORCED CONCRETE

Steel Sash
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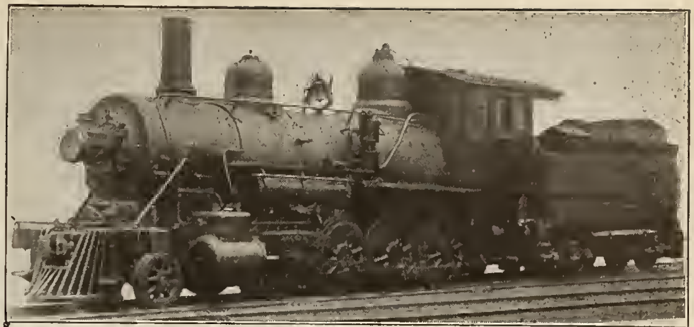
Rib Bars
Rib Metal

KAHN SYSTEM
Reinforced Concrete

Concrete Finishes
Water-proofing Pastes

STEEL FLORETYLE
FOR LONG SPAN CONSTRUCTION

Trussed Concrete Steel Co.
of Canada Limited
Head Offices and Works: Walkerville, Ont.
Branches Everywhere



Central Locomotive & Car Works

Largest Rebuilders of Railroad and Contractors equipment in America. Operate Two Extensive plants near Chicago. Have filled Large Orders of Equipment for Canadian Contractors.

We carry in stock **Locomotives of all types, Flat Cars, Center, Side** and **Air Dump Cars, Box** and **Gondola Cars.** Can make Prompt Deliveries. Prices Low.

Write for Specifications and Quotations on anything you need.

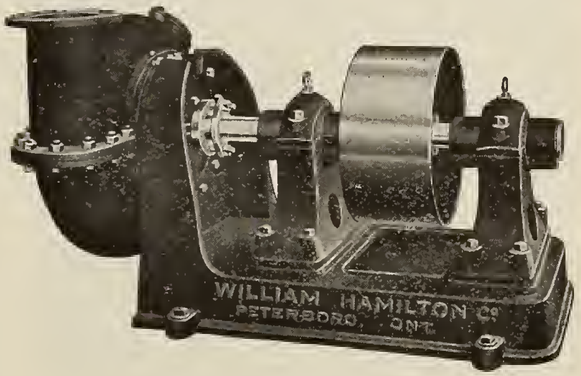
Central Locomotive & Car Works
410 Fisher Building **Dept. S**
Chicago, Ill.

$45. GARROW
Contractors Acetylene Flare Light

The great feature of this new light is strength and simplicity. The light is constructed of steel assembled by the Oxyacetylene Welding Process and consists of three parts. It is made to stand the roughest handling by unskilled labor without injury. A distinct advantage of the Garrow Light is its use in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame.

$45.00 F. O. B. Sudbury

The
Sudbury Construction & Machinery Co., Ltd.
Sudbury, Ont.



Contractors' Pumps

These pumps have been specially designed for contractors' use. They are made for belt, direct engine or motor drive.

They have special features not found in any other pumps, notably the horizontally split shell and the wide spacing between pulley and bearings.

They are built in all sizes from 2-in. to 14-in. discharge.

Ask for pump bulletin.

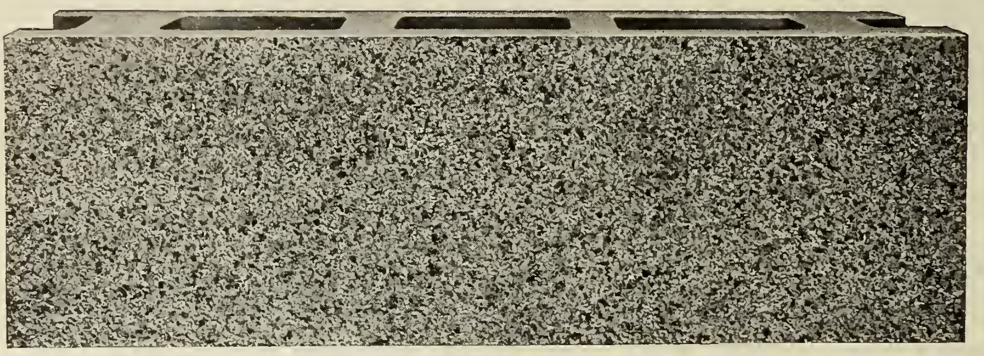
William Hamilton Company
Peterborough, Ontario

Zagelmeyer System

OF CASTING

Hollow Cement Building Blocks

With Granite Faces



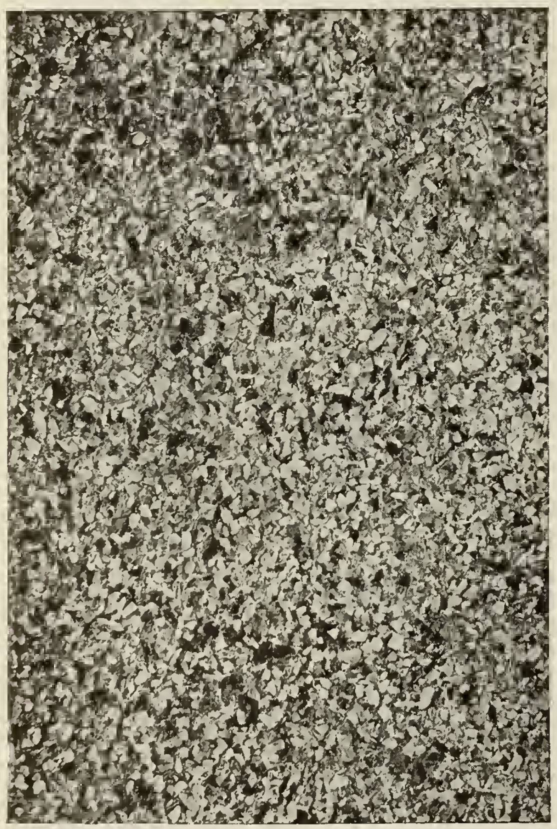
8 x 8 x 24 inch Granite Smooth Face Block

They cost less

They sell for more

You sell more of them

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



Enlarged View of Granite Smooth Facing

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold or moisture.

8 x 8 x 24 inch Granite Rock Face Block

Send us fifty cents and we will send, freight prepaid, to any point in Ontario, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

MR. BLOCK MAKER:—

What show will you have if your competitor secures the exclusive right for this system in your city?

MR. CONTRACTOR:—

Get into a business that is protected. Then you will make money.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Canadian Zagelmeyer Co.

Limited

298 Howard Ave., Windsor, Ontario

Hull Iron & Steel Foundries, Limited

HULL, - QUEBEC

Manufacturers of

"Adamantine," Chrome and Manganese Steel Castings

(Annealed and Unannealed)

TRADE MARK

Machine - Moulded Gears up to 16 feet. Grey Iron, Semi-Steel, Brass, Bronze and Aluminum Castings.

Cement Mill Machinery

Our Specialty

Tube Mill Feeders
Griffin Mill Roll Heads
Ball Mill Plates for Krupp Mills
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McCaslin Conveyer Wheels with "Coplan" Self-Lubricating Bushings
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Screw Conveyer Bearings
Eccentric Hubs, Crusher Heads and Concave Strips for Gates Crushers
T. M. Revolving Feeders (new style) for Gates Tube Mills

Patterns for all these lines kept on hand.

We solicit your patronage and prompt attention will be given to tenders on above work.

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LIQUID KONKERIT

A Decorative and Damp-proof Coating for
Brick, Stone, Cement or Concrete Walls.

Being Specified by Leading Architects

Write for new booklet and color card.

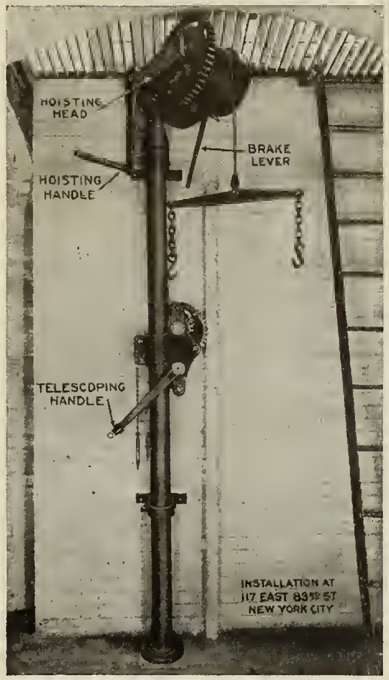
"R. I. W." DAMP RESISTING PAINT CO.

Office: 202 Mail Building, Toronto (TOCH BROS. Est. 1848.) Factory: Oakville, Ont.

DISTRIBUTORS—Black Building Supply Co., Limited, Toronto Western Paint Co., Winnipeg
Dartnell, Limited, Montreal Canadian Equipment & Supply Co., Limited, Calgary and Edmonton

Write nearest distributor for full information

G & G TELESCOPIC HOIST (PATENTED)



Compact—easy to erect. Takes up no room in basement.

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.

1.—It is telescopic—no part showing above sidewalk when not in use.
2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.
3.—Simple in construction and absolutely rigid when erected.
4.—It is made of strongest and most durable material.
5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.
6.—A powerful ratchet device is provided with both handles above mentioned.
7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.

Gillis & Geoghegan
544 West Broadway
New York

Hoisting head revolves. Can is deposited on Sidewalk without lifting.

Black Building Supply Co., Ltd. Agents for Ontario **Toronto**

B. & S. H. Thompson & Co., Ltd. Agents for Quebec **Montreal**

W. T. Grose Agents for Manitoba, Saskatchewan, Alberta **Winnipeg**

Wm. N. O'Neil Co., Ltd. Agents for British Columbia **Vancouver**

I'll Protect Your Concrete, Cement and Stucco Buildings Against Dampness

"I'm not particular about the size or style of the building—not at all. If the exterior is of brick, concrete, cement or stucco I'll make it moisture-proof and crack-proof with one coat—without destroying its distinctive features.

"I'll get right into the material and stay there until the building is torn down. I'll do better service than two coats of lead and oil, and will refuse to admit dampness of any description.

"When I go on metal lath, steel or iron girders or on delicate machinery, disintegration hasn't a chance to get started. I never chip, dust, flake or peel off. My name is

Bay State Brick and Cement Coating

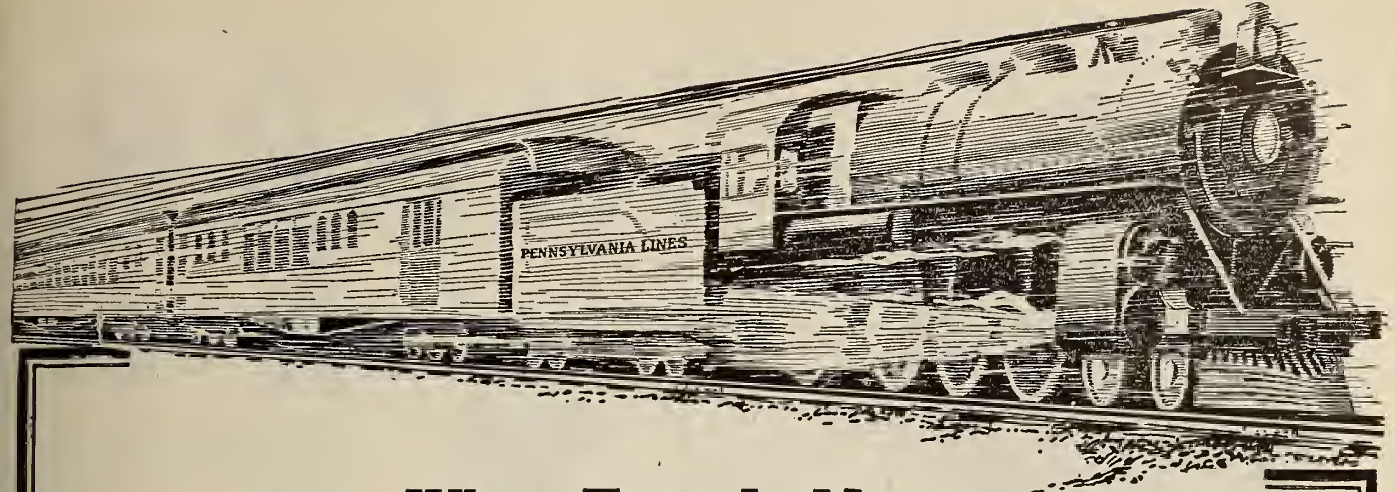
and I work just as well on interior woodwork and plaster as on exteriors.

"Most everybody likes my appearance, as I am made in a number of beautiful flat tints. That's why any surface I am used on not only wears better but also looks better.

"Try me on your next job and we'll be friends from that time on. If your local dealer is out of stock send direct to the manufacturers for Booklet 10 and prices."

WADSWORTH, HOWLAND & CO., Inc.

Paint and Varnish Makers and Lead Corroders **BOSTON, MASS.**

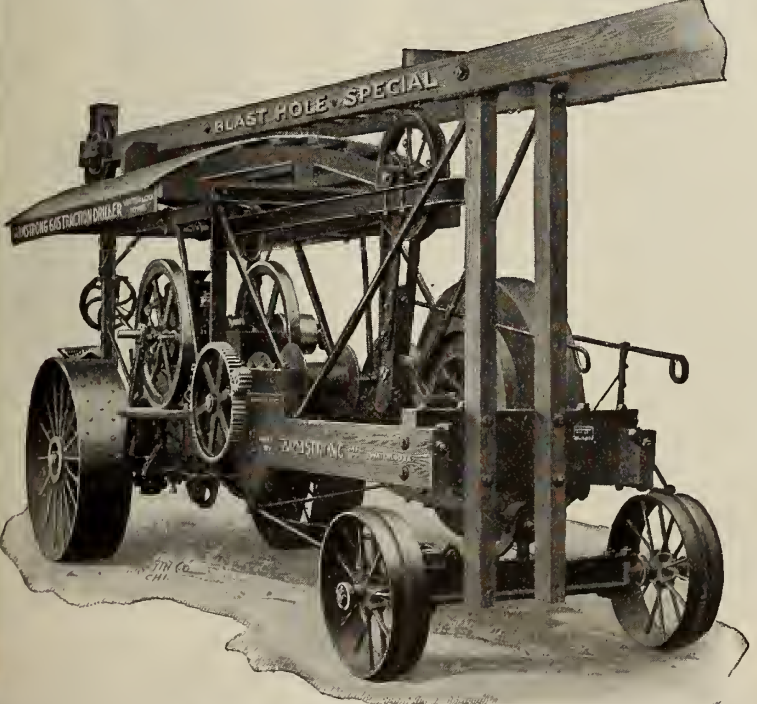


When Time Is Money
You Take the Limited—Not the Local

Buy an Armstrong Special Blast Hole Drill. It works faster, makes fewer stops, and saves *your* time. Time means *money to you.* Saves time because it drills more hole in a given time than any other cable drill—this is due to a special spudding beam and motion which allows both for longer strokes and a greater number. Each stroke is unhampered, due to the free fall which the Armstrong Special allows the string of tools. There are fewer stops because the Armstrong Special is designed for rock drilling alone and repairs and breakage are practically eliminated. The maintenance cost is lowered because the whipping of the cable is eliminated.

Armstrong machines are equipped with our powerful gasoline engines, made in our own factory, which are especially designed for this machine to give continuous and rapid operation. They are built with the idea that the operator is there to watch the drilling and not the engine.

We could not afford to give you our guarantee nor put our name on the machine if the Armstrong Special would not deliver all that we claim and more.



Guarantee

We guarantee the Armstrong Special Blast Hole Drill to drill more hole in a given time than any other cable drill on the market, and we will write this in every sale contract we make.

Write for Bulletin S.

Armstrong
MFG. CO. WATERLOO, IOWA. U.S.A.
BUILT FOR SERVICE
SINCE 1867

Eastern and Export Office:
17 Battery Place
New York City

Western Branch:
3rd and San Pedro Sts.
Los Angeles, Cal.

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Drinkle Block No. 2, Saskatoon, Sask.

What's the Time?

There would be no argument on this subject if the "PULSYNETIC" Electric Clocks were installed.

They are invariably correct because they depend on the unvarying force of gravity.

Accurate and uniform time is shown throughout any building in which they are installed.

Easily fixed, no winding and no skilled attention is required.

Send for Book No. 5

which contains fullest information about all classes of Electric Clocks.

GENT & CO., Ltd.
Leicester, England

KERR

Hydrants and Gate Valves

are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of waterway, and are strong, compact and modern in design and construction.

Standard Compression Hydrant

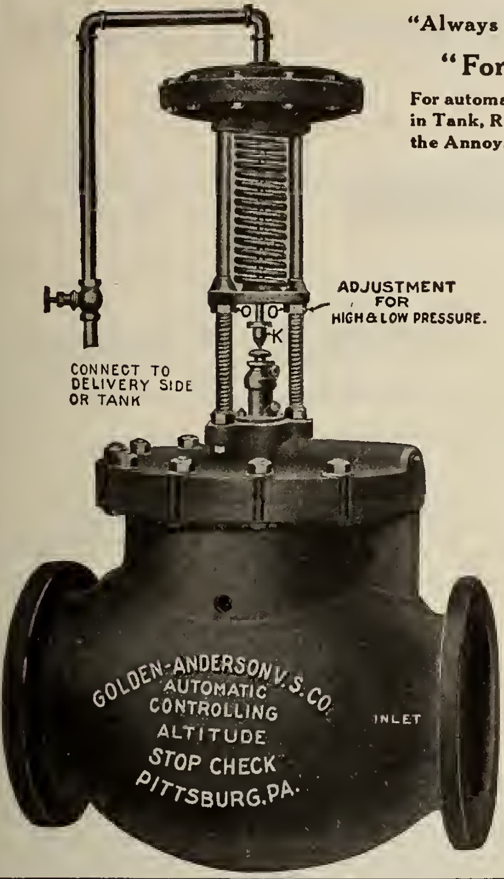
Send us your Specifications and Enquiries.

Prompt attention given.

6" Hubbed

THE KERR ENGINE CO.
LIMITED
WALKERVILLE, ONT.

The Golden-Anderson Pat. Cushioned Controlling Altitude Valves

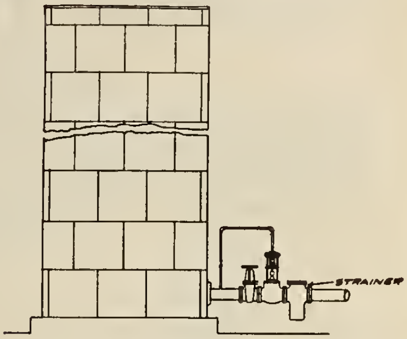

ADJUSTMENT FOR HIGH & LOW PRESSURE.
K
CONNECT TO DELIVERY SIDE OR TANK
INLET
GOLDEN-ANDERSON V. S. CO. AUTOMATIC CONTROLLING ALTITUDE STOP CHECK PITTSBURG.PA.

"Always Cushioned in Opening and Closing"

"For High and Low Pressure"

For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.

Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.



Automatic Cushioned Water Pressure Regulating Valves, up to 24"

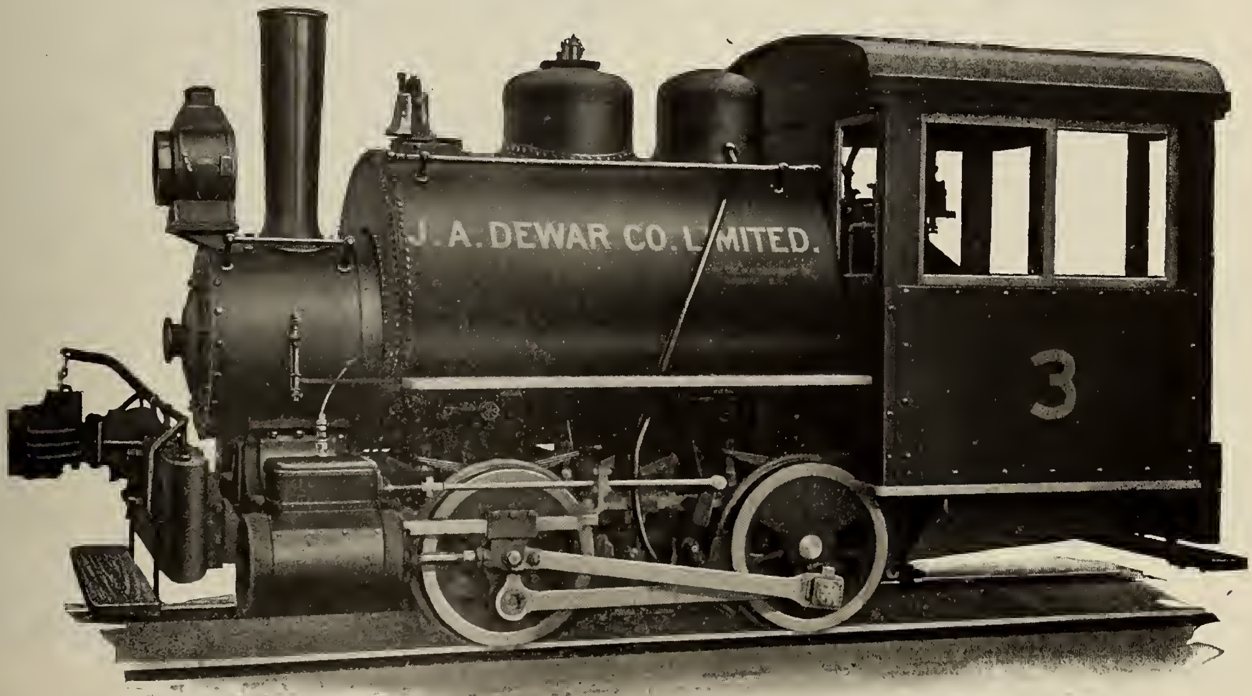
Golden-Anderson Float Valves

GOLDEN ANDERSON V.S.CO. FLOAT VALVE PITTSBURG.PA.

(Angle or Straight Way), up to 24"

Golden-Anderson Valve Specialty Co., 1247 Fulton Bldg. Pittsburgh, Pa.

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

Canadian Billings & Spencer, Limited

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TRADE MARK

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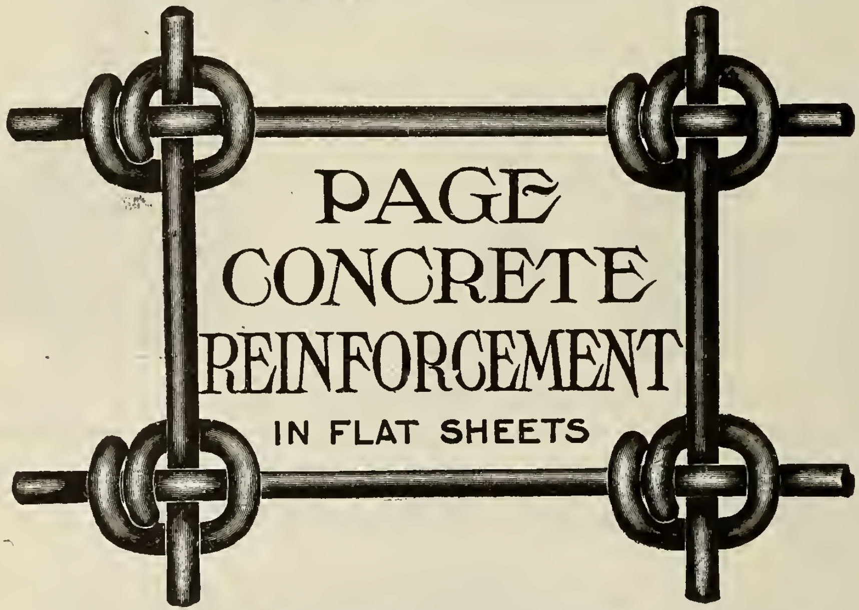
All types and sizes of
Standard Machine and Engineer's Wrenches

Welland, Ontario



PAGE Concrete Wire Reinforcement

for Concrete Road Pavement, Bridge and Building Floors

We are the originators of this wire reinforcement in flat sheets, and it is coming into universal use wherever introduced. We have supplied many carloads of it this season.

Can be supplied in rolls if preferred.

The standard mesh for road pavement is 6 x 12 inches; for bridges and building floors, the standard is 3 x 6 inches. All sheets 4 feet wide, and any length specified that can be loaded in cars.

PRICES per 100 sq. ft. delivered—6 x 12 mesh $0.75—3 x 6 mesh $2.25

Samples will be sent upon request.

The Page Wire Fence Company, Ltd., Walkerville Ontario

Branches:— Toronto Montreal St. John, N. B.

Sash Weights
and
Cast Washers

Manufactured by

Fittings, Limited, Oshawa
Montreal Winnipeg Vancouver

WELLS AND GRAY, LIMITED
Engineers and Contractors

Buildings and Construction Work
OF ALL KINDS
Reinforced Concrete a Specialty

Write us for preliminary plans,
estimates and photos of our work.

247 Confederation Life Building, TORONTO, ONT.

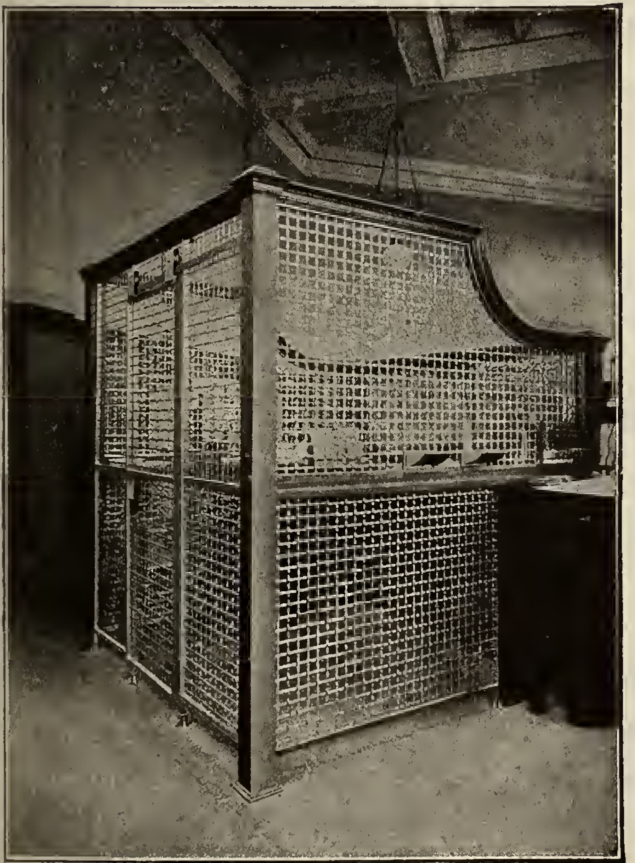
BANK and OFFICE FITTINGS

In Ornamental Iron and Bronze

Chaste and handsome in appearance, wrought by expert workmen in different finishes, from the best materials, our bank and office ornamental metal work has distinctiveness combined with high quality. Below is one example.

Our catalogue showing many designs of this class of work is yours for the asking and we are always glad to work in close harmony with the architect or interior contractor in the production of special designs.

DENNIS-LONDON ORNAMENTAL IRON



THE DENNIS WIRE AND IRON WORKS CO. LIMITED
LONDON
CANADA

MADE IN CANADA

"Sirocco" Spray Head

It's the design and operation of the spray heads that's responsible for the efficiency or inefficiency of an air conditioning system.

"Sirocco"
TRADE MARK.

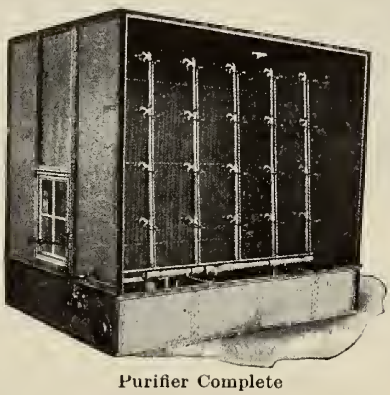
Purifiers, Coolers and Humidifiers

are equipped with spray heads which were designed to overcome the usual "clogging up" trouble. All heads can be flushed simultaneously by slightly turning a three-way cock located on the **outside** of the Purifier.

All heads are adjustable as to density of spray **and** can be permanently set at any desired point by means of a lock nut.

All heads are made of brass and accurately machined to template.

No packing is used.



Purifier Complete

Architects, Engineers and Contractors are invited to ask us for any information whatsoever regarding the design, construction, operation and application of Sirocco purifiers, Coolers and Humidifiers.

Write for Bulletin No. 2301.

CANADIAN Sirocco COMPANY
LIMITED
WINDSOR. ONTARIO.

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Wooden Water Pipe

Galvanized Wire Wound and Continuous Stave Pipe for Water Works, Power, Irrigation, etc.

Withstands 250 lb. working pressure.

Not affected by Frost, Corrosion, Electricity or Acid. Water Works Systems installed. Prompt attention to inquiries.

Write for prices.

Manufactured by

Canadian Pipe Co., Limited

P.O. BOX 915 **Factory: 550 Pacific St., VANCOUVER, B. C.**

Rosebery says:
"INTERNATIONAL"
in the end—why not
now?

Superior Construction

It spells longer life, less repairs, no breakdowns, constant service, greater output, and lower operating and mixing cost. On the next job use the

"INTERNATIONAL"

Concrete Mixers

GLOBE TYPE

Some New Improvements worth investigating:

Globe Drum, Steel Tracker Bands, Self Oiling Winding Drum and Tracker Wheels, Steel Chain Drive

Write to-day for complete Catalog
No. 60-98 and prices.

Large stock carried for immediate delivery

Power & Mining Machinery Co.

MILWAUKEE, Wis., U.S.A. *Factory:* Cudahy, Wis.

10 sizes, 4 to 100 cu. ft. per batch. Any power.
Agents wanted in open territory. M325.4

Basement Successfully Waterproofed Against 3½ ft. Water Pressure

The Watson House, Babylon, Long Island (shown here) is near the sea shore. Tide water subjects the basement to 3½ ft. water pressure. Being waterproofed with Ceresit the basement is now dust-dry all the time.

CERESIT TRADE MARK

The Dependable Waterproofer for Cement

Ceresit is a sure method of waterproofing concrete, cement mortar or cement stucco against any condition of dampness or water pressure. Its method of use is simple. It is a paste to be mixed with the gauging water. The water, being the carrying agent, insures perfect and uniform distribution of Ceresit throughout the mass.

Write for the 1914 "Book of Evidence" which gives complete and interesting facts about Ceresit

Ceresit Waterproofing Co.

913 Westminster Bldg., CHICAGO

FACTORIES—Chicago, Unna, Germany: London, Paris, Vienna, Warsaw

LIST OF DEALERS—W. B. Poucher, Edmonton, Alta.; E. G. Cullen, Vancouver, B.C.; Walkers, Ltd., Winnipeg, Man.; R. deB. Carrite, St. John, N.B.; W. K. Macdonald Co., Toronto, Ont.; McLelland Peters Co., 305 Read Bldg., Montreal; The Whitlock-Riddell Co., Moose Jaw, Sask.; Brown & Chapman, Regina, Sask.; MacKenzie & Thayer, Ltd., Saskatoon, Sask.; N. G. DeHaas, Sault St. Marie, Ont.

After testing 2,036 samples—

of rail steel reinforcing bars, Professor Hatt, of Purdue University, who supervised the tests for a special committee appointed by the American Society for Testing Materials, reported that:

> The material showed remarkable uniformity, as eighty per cent. of the bars did not vary more than twelve per cent. from the mean in tensile strength.
> Rail steel showed an excess ductility for its strength above the usual grades of steel.
> The process of manufacture has raised the mechanical quality of the material.

Burlington Steel Bars for concrete reinforcing

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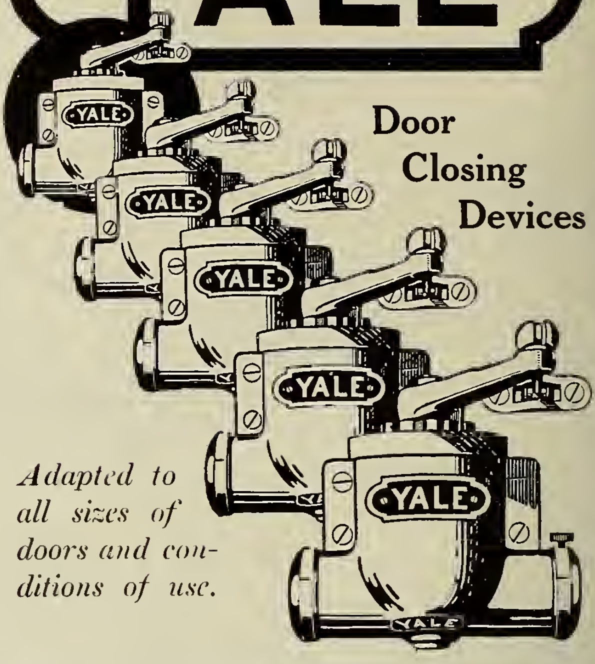

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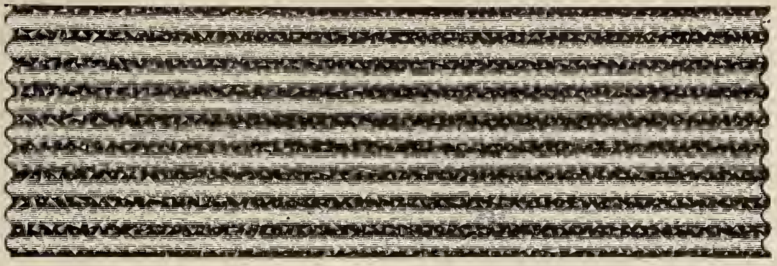

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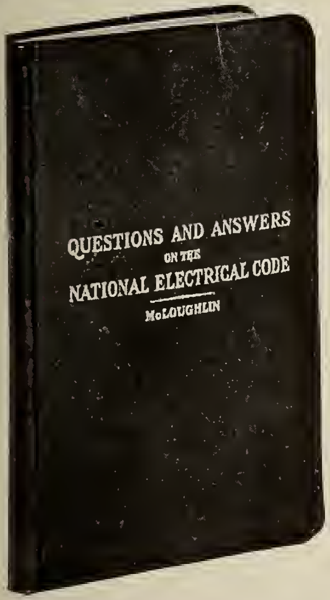

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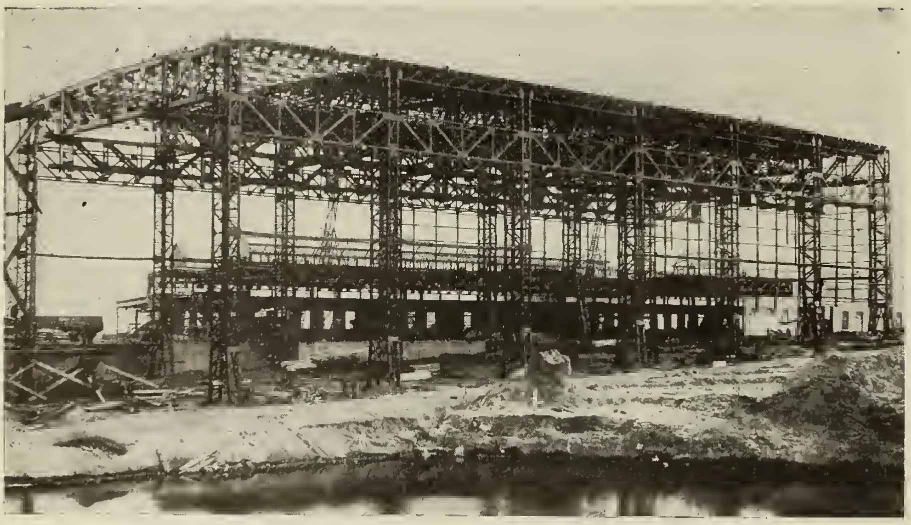

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Business Treason in a New Garb

WERE outside contractors to follow closely the contract procedure of British Columbia, it is a safe venture that that enlightened province would soon have the field of its constructional activities to itself. As recounted editorially in a recent issue of this journal, the City Council of Vancouver not long since awarded to a local firm the contract for a supply of valves, notwithstanding the fact that their bid was twenty-two per cent. higher than that of a United States competitor. There now comes to light the interesting fact that the Council also overlooked an Ontario firm's tender which was only one per cent. higher than the bid submitted by the United States firm. It is additionally interesting to learn that the Ontario concern in question has been obliged to tender on Vancouver contracts through a local jobbing house, as the City Council practically insists upon purchasing locally. Assuming that the jobbing house would get from three to five per cent. for handling the business it is easily seen how outsiders are handicapped.

This particular case would seem to constitute a strong plea for the adoption of a suggestion made a few years ago by the London, Eng., correspondent of this journal—namely, to award contracts to the lowest bidder but one. As a general rule we have not favored innovations of this kind, believing that corruption would inevitably be associated with the authority to discard the low bid. But we have always urged that reasonable discrimination should be exercised by responsible officials and that all facts and figures should be above board and readily available to all. In this instance there was a practically negligible difference between the lowest bid and the lowest bid but one, and the latter was submitted by a Canadian company who for years had tendered successfully and satisfactorily to the city of Vancouver.

In passing over United States industries after inviting open competition, the Vancouver Council has been guilty of a breach of faith; in setting aside the claims of an Eastern Canada firm in excellent standing, it has been guilty of nothing short of business treason.

We return to the subject because we feel strongly that the province of British Columbia has put into effect a policy which is inimical to the best interests of the country. We say British Columbia advisedly because the pernicious example of Vancouver is spreading like a plague. Word reaches us that the city of Prince Rupert has just awarded a contract for waterworks supplies to a British Columbia firm in face of a lower price submitted by an Eastern concern.

We feel that it is essentially the function of a paper whose part is to record the constructional history of Canada from coast to coast, to promote, or strive to promote, the country's development on a national scale. Such broad expansion can never be effected if the British Columbia policy is adopted by the various provinces. In these strenuous days contractors have not the time to enter competitions in which the winners are selected beforehand; and it is a waste, not only of time, but of money, for the expense of tendering is a considerable item in the disbursements of any contracting concern. If the municipalities and business men of British Columbia hold to this policy of discrimination the province will soon be eliminated from the lists of outside concerns who find themselves faced with what is practically a protective duty of twenty-two to twenty-five per cent.

Recent contracts awarded in British Columbia have constituted grave injustice to outside manufacturers—and the province will have to pay in the long run. Breaches of faith in every sphere of human activity bring upon the perpetrators the strongest condemnation. The principle remains constant whether in war or love, business or sport. Germany's breach of faith in the invasion of Belgian territory has brought upon her the condemnation of the rest of the world—and the penalty may be her national existence. Search the pages of history and we find that breaches of confidence have resulted in the ultimate extermination of potentates and powers. Legitimate enterprise alone can survive the combinations which may be arrayed against us.

From their own standpoint the British Columbians' policy is a shortsighted one, for it cannot fail to bring about the refusal of outside manufacturers to tender on municipal work in the province; and it must be evident that if the market is left solely in the hands of local manufacturers the ratepayers will have to pay dearly for their local patriotism, or whatever other apologetic term they may find for it. For our part we regard such patriotism as treason in a new garb—and it was only in our last issue that our London correspondent reminded us of how Dr. Johnson once defined this sentiment as "the last resort of a scoundrel," so that we are in good company.

Where Angels Fear to Tread

CITY Councils throughout the country are undecided as to the action they should take in regard to the salaries and positions of men who have volunteered for active service. In a number of cases it has been suggested that they should receive full pay and in other instances half pay has been suggested. It seems to us that promises of assistance of this kind should be given only at the greatest discretion. Up to the present time there has been no lack of volunteers, and the first contingent might well be composed of reservists and others who are under some obligation to the Imperial Government, supplementing them, of course, by others whose private circumstances enable them to leave no responsibilities behind them. As yet it is a far cry to the time when every able-bodied man will be called upon to shoulder his rifle in the offensive or defensive tactics of his country, and City Councils should proceed warily and not rush into obligations which may be difficult to fulfil later. Perhaps, after all, the best patriot is he who remains cool and collected at his post until his services are actually required. No better loyalty is to be found than in this country, and we are ready to a man, but we must not encourage the parade of reckless sacrifice and adventurousness under the cloak of patriotism. It must be remembered that service is required at home as well as abroad and that strong men are required to remain in charge of the country's business affairs just as much as other strong men are needed in the firing line of the allies. Financial undertakings of the kind under discussion should be entered into only after the calmest deliberation and judgment. At the present juncture it is not incumbent upon us to suspend constructional and all other enterprise, and an equal burden of responsibility should be laid upon all—civic employees not excepted.

Good Roads as Crop Producers

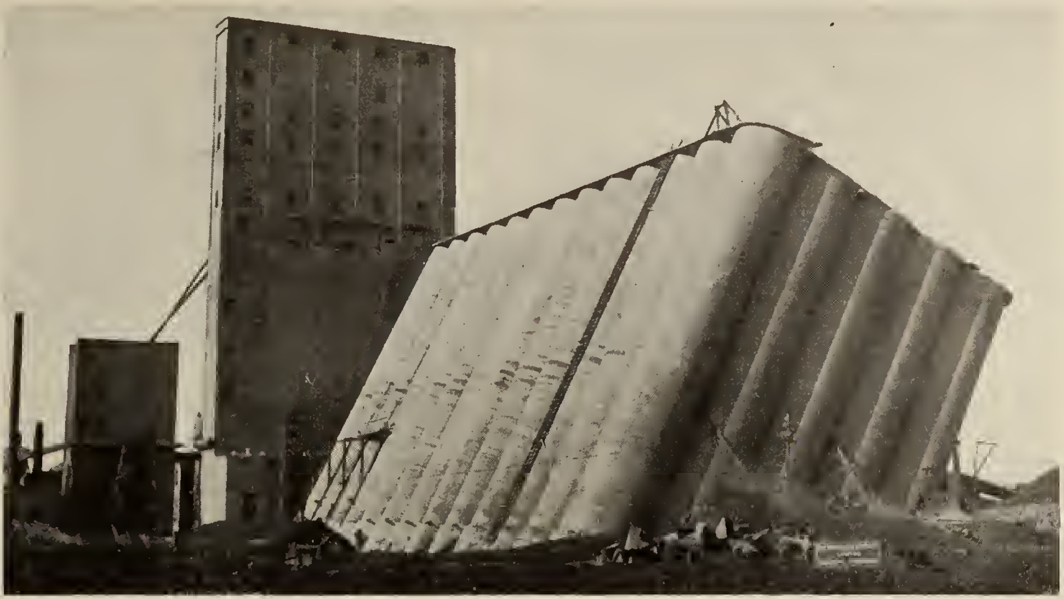
THAT an improved road will increase vastly the productiveness of the area through which it runs, has now been satisfactorily demonstrated by studies conducted by the United States Department of Agriculture in Virginia. Conditions in Spotsylvania county were investigated with particular care and the results have proved surprising. In 1909, the county voted $100,000 to improve forty miles of roads. Two years after the completion of this work the railroad took away in twelve months from Fredericksburg, the county seat, 71,000 tons of agricultural and forest products, hauled over the highways to that town. Before the improvement of the roads this total was only 49,000 tons annually; in other words the quantity of the county's produce had risen more than 45 per cent. Still more interesting, however, is the increase shown in the quantity of the dairy products. In 1909 these amounted to 114,815 pounds, in 1911 to 273,028 pounds, an increase of practically 140 per cent. in two years. In the same time shipments of wheat had increased 59 per cent., tobacco 31 per cent. and lumber and other forest products 48 per cent.

In addition to this increase in quantity the cost of hauling each ton of produce was materially reduced. In other words, the farmers not only produce more but produce more cheaply, for the cost of transportation to market is, of course, an important factor in the cost of production. In the past two years the traffic studies of the Federal experts show that approximately an average of 65,000 tons of outgoing products were hauled over the improved roads in the county an average distance of 8 miles, or a total of 520,000 ton-miles. Before the roads were improved it was estimated that the average cost of hauling was 20 cents a ton-mile. After the improvement this fell to 12 cents a ton-mile, or a saving of 8 cents. A saving of 8 cents per mile on 520,000 ton-miles is $41,000 a year. The county's investment of $100,000 in other words returns a dividend of 40 per cent. annually.

Because this saving, in cases of this character, does not take the form of cash put directly into the farmer's pocket there is a widespread tendency to believe that it is fictitious profit, while as a matter of fact it is just as real a source of profit as the increase in the price of wheat.

In Dinwiddie County, Virginia, for example, where peanuts are one of the staple crops, the average load for two mules on a main road was about 1,000 pounds before the road was improved. After its improvement the average load was found to be 2,000 pounds and the time consumed in hauling the larger load to market was much reduced. In other words, one man with a wagon and two mules could do more than twice as much work with the improved road than with an unimproved road. This is the explanation of the extraordinary rise in the total output of agricultural products in a county with a good road system.—Municipal Engineering.

War or no war, we are told, the Greater Winnipeg water district aqueduct, railway and other works will proceed without check. Mayor Deacon, of Winnipeg, who is chairman of the water district, states that the scheme is on a perfectly sound financial basis and that nothing short of armed invasion by a hostile force will delay the work in the least.



The North Transcona Elevator as it appeared after failure. General view from north-east. Angle of inclination of bins, 26 deg. 53 min.

Straightening the North Transcona Elevator

Methods Employed in the Solution of Unique Problems—Underpinning Work House and Restoring Bins to the Vertical

Specially Contributed by Alexander Allaire*

Of the many remarkable constructional jobs now under way in Canada probably none exceeds in interest the straightening operations in connection with the North Transcona elevator.

The failure of the C. P. R. 1,000,000-bushel grain elevator last Autumn (when, just after receiving its full capacity, the storage bin section settled into the ground and over to one side to a final angle of 26 deg. 53 min.) was caused by the failure of the underlying strata of clay. A decision was soon reached that it would be a practical and economical proposition to try to restore these bins to their former position.

The first thing done was to make an extensive series of borings around the buildings. Eight holes were sunk with the following average result. Starting from the prairie level the different earth strata passed through down to limestone bed rock at elevation—53 ft. were: (1) 35 feet of stiff blue clay; (2) 7 feet of soft white clay and boulders; (3) 7 feet of harder white clay and gravel; (4) 4 feet of shattered limestone, rock and boulders.

The workhouse portion of the structure was not affected by the failure of the bins. It was decided, however, to insure against possible movement of this building by underpinning it with concrete shafts bottomed on bed rock. This work was started in December, 1913, and successfully finished by June of this year. The building is 70 ft. x 96 ft. in area, 180 ft. high and weighs some 13,000 tons. It has been underpinned so efficiently that no settlement or movement of any kind took place, and no cracks appeared.

Forty-four concrete piers, or shafts, were sunk—twenty-four directly under the columns of the building and twenty around the outside, to act as heels for heavy shoring timbers. These outside shafts were sunk first so that the shores resting on them could be erected and brought into action, thus supporting the building laterally, while the interior columns were being underpinned. Six of them were sunk by means of cast iron shoring cylinders—a safe and positive method. The cylinder was made up of sections, each 4 ft. outside diameter and 3 ft. in height. The sections were fastened to one another by bolting through inside flanges at each end of the section. As the sinking progressed, the cylinder was jacked down into place from above, and new sections were inserted and connected at the ground level.

From the knowledge thus gained of the exact soil conditions under the building, it was considered quite safe to use the cheaper Chicago well method for sinking the remainder of the outside shoring shafts and all of the interior ones. The fourteen remaining outside piers presented no special difficulties and were sunk in the usual manner. The piers under the building columns were much more difficult, however, this being due to the necessity of cutting through the concrete mattress and approaching them by means of tunnels, and to the heavy load upon the columns. For twelve interior columns the total dead load was 3,320 tons and the live load 5,008 tons—making a total of 8,328 tons. The outside columns carried 1,728 and 2,512 tons dead and live load respectively.

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*Western Manager, The Foundation Company, Limited.

The method employed in sinking these interior wells was, where possible, to work four columns from a single shaft sunk midway between them. After cutting through the concrete mattress (2 ft. 6 ins. thick) the shaft was carried down to a depth of 7 feet below the matt. From this central shaft, tunnels were driven under the mattress to points underneath each of the four columns commanded by the shaft. Only one sinking well in this set was operated at a time. Single drum belt-driven hoists, operated by d.c. motors, were used to hoist material from the wells. As these motors formed part of the permanent equipment of the elevator, this proved a cheap and efficient method. In some cases it was not possible to group four shafts together, and two were worked from the same opening situated between them.

Three sets of shoring timbers had been installed around the building and these relieved the loads on the interior columns while the work underneath was going on. The outer set consisted of a B. C. fir timber unit made up of five 12-in x 12-in. sticks bolted and strapped together, and stretched from heel-blocks resting on the outside line of shoring piers to head blocks engaging the flared heads (at the second storey level) of the next inside line of columns. The next set of shores, consisting of two 12-in. x 12-in. timbers, stretched from the same heel blocks to head blocks engaging the flared column heads (also at the second storey level) of the second inside line of columns. The third set of shores, made up of four 12-in. x 12-in. timbers, stretched from the spread footings of the first interior line of columns to niches cut (at the first storey level) in the next inside line of columns. Two of the accompanying pictures show the heel and head blocks for an outside shoring unit.

A concrete mixture of 1:2½:4½ was used for the piers underneath both the workhouse and bins.

Operations on the bins were started on March 2nd, 1914, and it is expected that they will be righted approximately to their former position by October. The structure is 77 feet x 200 feet in area and 92 feet high above the base of the bins, or 102 feet above the bottom of the reinforced concrete mattress, which is two feet thick. There are sixty-five bins, in five rows of thirteen each. The total dead load of the structure is 20,000 tons.

The work was begun by opening up a large trench on the east side. The fundamental scheme in connection with the restorative measures is to allow the bins to settle back, due to their own weight, hinging or heeling on the low side. This trench was to serve as a relief space for the clay bulging ahead of the falling mattress. The trench excavation amounted to some 9,000 yards, and the bottom of the excavation was carried ten feet below the bottom of the mattress on that side. The hand and team method of excavation was decided on, owing to the nature of the material at that time of the year (early spring-melting weather), the clay being too sticky and tough to be economically handled by a steam shovel—the only other feasible method under the circumstances.

Straightening the North Transcona Elevator

On the left is a view showing head block for outside shoring unit; on the right the reproduction is from a photograph of the east trench, showing method of disposal.

From this east trench, drifts 4 ft. wide and 9 ft. deep at the edge of the mattress, were driven westwards under the mattress diminishing in depth to about 3 ft. at the centre of the building. These were spaced 15 ft. apart, centre to centre. A belt conveyor was installed in the trench close to the entrance to the tunnels and carried away the spoil from them. The material, after being carried to the north end of the building, was dumped on to another belt conveyor, inclined at an angle of 18 deg., discharging up and out into a wooden hopper (capacity 10 cu. yds.) from which the dirt was chuted into wagons and carried away.

To carry the building after righting and to furnish secure foundations for cribbing and jacking units during the process of righting, it was decided to sink seventy concrete shafts under the mattress, each one resting on rock. These shafts were spaced in five rows of fourteen each, and every pier was placed underneath a contact wall between two bins. The outside piers on the north and south ends of the building were made

General view of east side excavation and shoring.

Mattress at east (high) side, showing cribbing, screws and struts.

6 ft. 6 ins. outside diameter, but the inside ones 7 ft. Holes, 4 ft. 6 ins. square at the site of each pier, were cut through the reinforced concrete mattress in order to reach the clay, the cutting being done with Ingersol butterfly jackhammer drills. All of the shafts under the bins are being sunk by the Chicago well method, the hoisting of material being handled, where possible, by single-drum belt-driven electric hoists, and otherwise by hand winches.

The most difficult, and at the same time the most important, row of piers on the job—that underneath the low side of the bins—was finished first. To reach it through the maze of passage-ways between the mattress and the bin floor, and to convey material to and from it, much less to work in it, was a very difficult proposition, but the piers were all completed well up to schedule time and all landed on first-class bottoms. Immediately after bringing the top of the concrete in the wells to 5 ft. 2 ins. from the mattress, a heavy crib of 12-in. x 12-in. white oak timbers was placed on top of each pier and wedged tightly against the bottom of the mattress. On this line of piers as a fulcrum, the building as a whole, has been slowly hinging back to its original position. To date (August 4) the angle of inclination has been reduced 7 deg. 20 min., and the high side of the mattress has dropped 9 ft. 6 ins.

As the building has settled, it has forced ahead of it, to the east, the clay immediately under the mattress instead of mounting or riding it, as one might possibly imagine. This clay has been disposed of mostly by means of the belt-conveyor in the east trench, previously mentioned, and partly by bleeding out through holes in the mattress on the high side of the bins. As fast as possible, cribs were built on the completed piers underneath the high side and clusters of powerful steel shoring screws were set on them and wedged up to the mattress. These screws, together with numerous posts set on mud sills (all 12-in. x 12-in. timber), have been gradually taking more and more of the load of the eastern or high side of the building as the earth excavation under that side has progressed. Two of the accompanying pictures show conditions at this side of the structure at this stage of the work.

By carefully and systematically slackening the screws, it has been possible, to date, to control the downward movement of the bins absolutely. One of the dangers watched for most carefully was that of letting the screws down too fast for fear the structure might crack. Another was that of the screws bending (and possibly breaking under the enormous weight) due to the angle of contact of the screws with the mattress and the fact that in moving downward the mattress was describing an arc of a circle. To assist in this downward rotating movement of the bins, a row of timber pushers was placed on the west, or low side, footing against a massive continuous mud sill made up of 12-in. x 12-in. timbers. The head blocks and the long head rangers, running the full length of the building, were also made up of 12-in. x 12-in. timbers. The pushers themselves were made up of three 12-in. x 12-in. pieces, 55 feet long, strapped together. Three shoring screws were installed at the heel of each pusher—one in each timber—and were kept continuously under load.

When the screws were run out as far as possible they were "fleeted," or tightened again by inserting cribs between them and the heel ranger. A general view of these pushers accompanies this article.

Considerable water has been encountered in the

General view of west side pushers.

Discharge ditch for pump water. Note dirt hopper at head of inclined belt conveyor on the left.

stratum of shattered limestone just above bed rock. It is estimated that during June, while the most difficult wells were being sunk and concreted, as much as 1,150 gallons a minute, 24 hours a day for several days consecutively, was handled by the pumps on the job. This total is all the more striking when one considers the conditions. Owing to the fact that facilities for moving the pumps about in the passage-ways beneath the bins were so poor, and the available opening through the mattress at the site of a well was so small, none but the very lightest and smallest sinking pumps were used. The well-known pulsometer was the type which gave the most satisfaction under the conditions described. These small, light, sinking pumps discharged from the interior wells into a deep sump pit at the north end of the building. From this the water was pumped and discharged into nearby road drainage ditches by means of powerful steam reciprocating and electric belt-driven centrifugal pumps. For the open shafts under the high side of the mattress where the conditions for placing and handling the pumps were much more favourable, the centrifugal type, belt-driven by electric motors, was found to be by far the most satisfactory. Rigged up as a sinking pump, the motor and centrifugal were both placed on a caged platform, this being hung inside guide timbers by means of block and tackle, and lowered or raised as the water level below demanded. In this way the advantage of a short suction hose was obtained and easily maintained.

The pumping plant at the job consisted of five No. 3 Pulsometers, one No. 4 Pulsometer, one No. 2 Nye pump, one No. 3 Nye, one No. 4 Nye, one No. 1 Emerson sinker, one Prescott mine sinker (6-in. discharge), one No. 8 Cameron sinker, two No. 10 Camerons, one No. 4 Swaby belt-driven centrifugal, one No. 5 Swaby centrifugal belt-driven, and two No. 4 Gould belt-driven centrifugals.

Where all the water came from is not definitely known. It is thought, however, to be part of the same enormous underground river that underlies Winnipeg, and from which the city's present artesian water supply is obtained.

At the time of writing, the average downward movement of the high side of the mattress is 6 ins. per day of 24 hours.

As soon as the middle row of piers is finished, a heavy crib of oak and fir will be placed on each one of them, and, on top of these, oak rockers, wedged up tightly to the mattress. The cribs on the lowest inside line of shafts, about which the building is at present pivoting, are also being enlarged and strengthened; so that when the angle of inclination is approximately 15 degrees, it is expected that the overhanging weight of the east side of the building, combined with a powerful upward force exerted by shoring screws on the two west lines of piers, will cause the structure, as a whole, to rotate or pivot on the rockers on the middle row and rise to its final vertical position.

All the work in connection with the underpinning of the work house and the righting of the bins is being done by The Foundation Company, Limited, of Montreal and Vancouver.

The Organization of a Municipal Engineer's Department*

By Edward Willis, Assoc. M, Inst. C.E., F.S.I.†

To every engineer and surveyor having the management of any large town or city, a thorough knowledge of organization is most important. It is also especially important to the young engineer appointed to a small district since, although he will not have a large staff, it usually becomes necessary systematically to apportion his time and the time even of an assistant, pupil, or office boy, in such a manner that it can be utilized to the best advantage, and no portion of the necessary work appertaining to his department be neglected. . . .

In approaching the subject the author is met with the initial difficulty of the large variation in the work and responsibilities that the municipal engineer has to undertake, and he therefore proposes to deal briefly with only those duties which appertain to practically all appointments, while he will touch but very lightly upon those branches of the department which in large towns and cities are often placed under a separate head, but which in the smaller towns are usually added to the multifarious responsibilities placed upon and undertaken by the modern municipal engineer and surveyor.

Assuming that it is possible to create a new and complete department, the author would suggest the following main headings as the basis of its organization:—(a) Highways; (b) sewerage and sewage disposal works; (c) architectural work and supervision of buildings; (d) open spaces, parks, and pleasure grounds; (e) collection, removal, and disposal of house refuse; (f) sanitary administration, including public conveniences; (g) housing and town planning; (h) fire protection and extinction; (i) stores and depots; (j) miscellaneous; (k) establishment and staff.

The real essence of good organization is the efficient and harmonious working of each section of all departments, with no friction or wasted time where two sections overlap or become interwoven. It is often in this overlapping between the separate sections of a department that most difficulties arise, loss of time is incurred, and individual character, ability, and tact are required to avoid friction.

In the creation of a department for a new small urban district it will probably be found that a very small staff will be allowed for a considerable amount of work, and this must result in several sections of the work being thrown upon one individual. If, however, the scheme is properly thought out and organized, its development will be automatic with the increased prosperity of the district, and no reorganization, with its consequent possible upheavals and heartburnings, should ever become necessary.

It may be desirable before dealing with the above sub-headings to say a few words about the personnel of a staff.

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† Engineer and Surveyor of the Chiswick Urban District Council.

In considering the smallest type of urban district, it may be assumed the staff of the municipal engineer's department consists of one man, described in that most comprehensive word "The Surveyor." If his council are particularly generous he may have the advantage of a pupil and office boy. In this case but little organmation of staff will become necessary, but the organization of work is a sine qua non if the administration of the district is to be efficient, and no harm can result from the scheme of such work being considered on broad, but definite, lines; in fact, the man that can grasp and deal with his work on broad lines is individually the most useful and best organizer, provided he can likewise appreciate the importance of detail.

In the case, however, of an average municipal engineer's office in a town of, say, from 10,000 to 50,000 inhabitants, the circumstances are undoubtedly very different from the foregoing. The borough or district is probably already in a flourishing condition. It may be a quiet town, or it may be rapidly developing, the latter being probably the case in a town or suburb immediately adjoining the Metropolis or some of the great cities of the Empire, or in one which is being developed owing to the creation of a thriving industry within its boundaries.

Arrangements for expansion or possible decentralization may therefore be anticipated and provided for; the individual abilities of each member of the staff should be appreciated to a nicety; the work in each section of the department should be defined and systematic; supervision should be accorded to all; absolute punctuality should be enforced, and integrity of thought as well as of deed should be fostered.

It might be here mentioned that some officials, while being absolutely above reproach in financial matters, still have not grasped that absolute integrity includes principles as well as actions, and the head of a department who can feel that not only integrity, but absolute loyalty to himself permeates every member of his department is indeed fortunate, and such a knowledge is very helpful when the anxieties and worries of dealing with the numerous members of a large corporation weigh unduly heavily upon him.

It cannot be too much emphasized that a true esprit de corps should exist in every official, from the highest to the lowest, to ensure that perfect harmony in work which gives the most beneficial results to the council and ratepayers at large, and therefore any scheme which an engineer can advance to further this spirit will not only redound to his credit, but will probably add to his popularity, and make every individual member of the staff willingly throw his whole energies into his daily work, and not cavil or murmur when the exigencies of the public service necessitate hours of overtime, often without any thanks from his council.

Highways

As the construction and management of highways created the necessity for the surveyor and engineer, so it still ranks as one of the most important duties attaching to his department, and in the majority of districts it is organized as a separate section or subdepartment.

The number of men engaged in maintenance and supervision must of necessity be governed by the area and the traffic throughout the district, but in practice the author advises that existing highways should be dealt with separately from the construction of new highways, since the latter largely consist of private street works and street improvements, and as such are subject to more detailed drawing and office work than the maintenance of existing roads.

The author is of opinion that even in a small district it is wise to make one man responsible for the administration of this sub-department, so that the entire maintenance of the existing roads and footpaths of a district are in his hands. He would then have charge of watering, scavenging, and repairs, including all team labour, manual labour and stores used upon public highways.

The question of improvements to existing highways and lighting in a small district is also left in this official's hands; but where the administration of a large town or city is to be dealt with, he is of opinion that the supervision of both improvements and lighting can be relegated to two other officials, who can personally report to him and specialize in their particular work.

Some engineers require personal reporting daily from the head of each sub-department, and this system has many advantages. At the same time the author has found in practice that there are equally great disadvantages, since in his own experience he has wasted hours in obtaining access to his chief to report sometimes comparatively trivial matters, and the procedure he has adopted in his own office is to obtain all reports in writing from the foregoing officials, who attend for interviews only when required.

Before concluding these observations on existing highways the author would like to emphasise the desirability of not only recording the materials and labour expended on repairs through the outgoing stores notes, but also the advisability of keeping abstracts, charts, and maps of the district showing exactly, from time to time, with the date attached, the amount of recoating carriageways or repaving footpaths carried out each year, and, as far as possible, the prime cost should be kept of all such work and reduced to a definite standard.

While advocating this the author must admit he has been unable, with a limited staff, to keep entirely to this standard of perfection; but he still advises the continuance of such a system as being ultimately conducive to both economy and efficiency.

With reference to watering, he has made a practice of attaching to each water van a small skeleton map of the beat, with positions of all road-watering posts shown thereon, as this tends to prevent the continual waste of time which will constantly occur where the number of road-watering posts is limited, and enables a better check to be maintained over the employees.

The question of scavenging with gangs or one-man beats is a vexed question, and in most districts too little money is put on this important work. The quality of the labour also is often far from satisfactory, any man being considered fit to handle a broom. This is not the author's experience, as he has found that one man can often do twice the amount of work as another, and that such work is often more efficiently performed.

The author considers new highways, especially private street works, can often in a large district be left in the hands of one capable assistant, with one or two draughtsmen to assist him, since uniformity in practice with private street work and apportionments is conducive to lessening of friction with speculating builders and small property owners.

It is desirable that provisional and final apportionment books be kept in lieu of loose sheets, and that such books should give full particulars of the ownership, frontage, estimate,' final account and final apportionment, so that the past history of a private street can easily be traced without the necessity of unduly "wading through" numerous loose papers.

In some districts it is customary to have an absolutely standard specification and drawing for private street works; but this has not been the author's practice, since what may be desirable for one highway may be totally unsuitable for another, and in recent years under this heading the author has used from 9 in. to 21 in. of total formation and the following finished surfaces: 9 in. to 6 in. of flints; flints tar-painted and finished with granite clippings; tarred granite; tarred clinker finished with tarred limestone; Guernsey granite with Tarvia and granite chippings.

One other point before leaving this subject may be usefully mentioned. Where trees in streets are generally adopted, they may often be included in the private street works specification and estimated with advantage as well as grass margins, if the cost of maintenance can be reasonably afforded.

Careful records of renaming and renumbering must also be kept, as certificates are continually being required when property changes hands.

Sewerage and Sewage Disposal Works

In this sub-department the author suggests the separation of new and existing sewers from sewage disposal works; in fact, in all large towns and cities such a separation is a sine qua non, in many cases the sewage disposal being undertaken by a joint board, and dealt with either by a sea outfall or bacterial treatment.

The variations in the management of sewage disposal works are, of course, entirely governed by the size and character of the works and the quantity of sewage treated; but it cannot be emphasized too strongly that where the outfall discharges into a non-tidal stream absolute adherence to instructions is essential, especially in the case of contact beds, where three shifts in twenty-four hours is adopted. In this case there is no excuse for lack of attention at night-time, but when men are working twelve or thirteen hours through the night, under little or no supervision, the author has found neglect sometimes ensues.

The author has made a practice of supervising or inspecting personally at all hours of the day and night, without notice, and he has found this has eliminated to a large extent the risk of serious neglect by his men.

Under the heading of "Sewerage" he suggests separating the management of new and existing sewers so far as the individual staff is concerned. This, of course, would again have reference to a large district, or one rapidly developing, and in practice he has found that the outdoor building department can well supervise the laying of new sewers without undue overlapping, since the majority of these are laid in new streets by private estate owners.

Maintenance, flushing and connections to sewers should be as far as possible under the control of one man, who should be solely responsible for seeing to the actual work of the sub-department, but in practice it is often found desirable to arrange for house connections to be supervised by the building department, which, as an inspector should be upon the works daily, saves time and eliminates overlapping of inspection.

It is needless to detail the many sub-headings that would apply in this section, but the author would emphasize the importance of any spare time being spent on keeping the surveys and levels absolutely up-to-date, and shown on the standard ordnance maps of the district. The surface and invert levels should be entered on such maps at every manhole or change of direction or gradient.

Open Spaces

In dealing with this important section of a municipal engineer's work, it may again be reasonably subdivided under the fallowing headings:—

Maintenance of existing open spaces.
Provision of new open spaces.

Briefly referring to the latter heading, the first consideration is defining the most suitable position and negotiating for it. This, of course, is exclusively a matter for the head of the department, probably in conjunction with the clerk of the council.

The design and lay-out construction of walks, banks, flower beds, shrubberies, gymnasia, drainage, water supply, chalets, conveniences, etc., would be best prepared by the indoor staff and the supervision undertaken by the outdoor staff.

A matter which is now continually before municipal engineers is the desirability or otherwise of executing certain new works by means of direct labour. The author has had experience of both the contact and administration systems to some large extent, and he is of opinion that there are many works in which direct labour can be economically adopted; but if they are to be successful and economy is to result, the engineer should have an absolutely free hand in regard to the employment of labour, and should be exonerated from the risk of criticism before the work starts, should he find it necessary to modify the labour conditions.

The question of direct labour is one which, at some time or other, is bound to be considered by every municipal engineer, and no one should neglect to take advantage of the experience of his confreres in this matter. Personally, the author has consistently adopted direct labour on new sewerage works and open spaces with both satisfactory and economical results, while he has found it also beneficial in the construction of open-air baths and various road improvements; but where buildings are to be erected, or where there is any question of payment by other persons, such as in private street works, he prefers the contract system.

The systematic upkeep of iron and wood work is often neglected through carelessness, bad organization, or false economy, and therefore one cannot be too careful in clearly defining the word "maintenance."

Collection, Removal, and Disposal of House Refuse

While this is one of the most important duties usually devolving upon the municipal engineer, it is equally one of the most unpleasant, and is probably the cause of more complaints than any other sub-department.

He must consider first the method of collection and disposal. Collection may be by contract or direct labour, and in each case by either horse haulage or motor traction.

Briefly, motor traction is beneficial where the shoot, deposit, or destructor is at a distance, or it can be economically adopted where the dustbins are placed on the footpath at night and are emptied daily. Direct labour can usually be more efficiently supervised and leads to fewer complaints than contract labour.

Having decided on the system, definite beats should be allocated to certain vans and collectors, and the collection from each beat should be completed each day. If this work is carried out properly no complaints should arise, but the author has found some difficulty in entirely avoiding these, owing partly to the substitution of other men during sickness or accident and the interference with normal organization during holiday seasons.

Some difficulties are also experienced in regard to empty houses or access to occupied houses when no one is at home, but the author's practice on such occasions is to deliver a card stating when the next collection will be made, and the men report on tabulated sheets the reason for non-collection. By this means it is possible to check whether non-collection is through the carelessness of the men or the temporary absence of the occupier.

In the disposal of house refuse, a proper record should be kept of the quantity received, preferably by means of a weighbridge at the destructor. This record should be checked with corresponding periods in previous years, and also with the average daily quantity, which should show a gradual increase with the growth of the district.

Special care is also required in testing the tare weight of collecting vehicles, since although it is wise to record the tare on every vehicle, dust vans are especially liable to be incorrect, owing to the inclusion of "tots," glasses, tins, shovels, baskets, etc., and unless special care is exercised in the clearing out of the vehicle, a considerable excess weight over the actual amount collected may be shown. This, in the case of piecework, may not always be accidental, and to avoid it the only proper method is to tare these vehicles out after every load.

In connection with the destructor, proper records should be kept, preferably in tabular form, of the amount of steam raised, water and coal (if any) consumed, power used for pumping or other purposes, quantity of clinker made, amount of clinker broken in crusher and used for special purposes, such as mortar, brick and flag making, tarred clinker for roads, etc., and a careful analysis of the cost of other materials and labour throughout, so that comparison may be made with corresponding figures at different periods and those of other local authorities, which, with proper allowances for varying conditions, form a good guide as to the economy and efficiency with which this section of the department is being administered.

In the case of extensive repairs to chimney shafts, main flues, etc., provision will have to be made for the removal of the refuse, by road, rail or water, to another destructor or shoot, and sufficient foresight must be exercised to avoid any interference with the normal daily collection and disposal of refuse.

Stores and Depots

A complete or even partial scheme of reorganization in connection with central or branch depots and storeyards requires most careful consideration, since after the cost of buildings, stabling, and other structural works for the reception of horses, vans, motors, rollers, etc., has once been incurred, the capital charge in the event of subsequent alteration will be entirely or very largely wasted. The greatest care and ability must therefore be exercised by the engineer before making any recommendation, and he must not only consider the present, but also the ultimate possibilities and needs of the area of which he is the controlling officer.

It is difficult to lay down any hard or fast line as to centralization, but it may be taken as an accepted fact that all horsed vehicles should be housed within a reasonable distance of the area upon which they are to be used. At the same time the multiplicity of storeyards or depots permanently increases the establishment charges, for which, as a general rule, a varying percentage is required to be added to the cost of works.

Establishment and Staff

The author cannot conclude without making a few observations under this heading. In the earlier part of the paper it was pointed out that perfect loyalty and absolute integrity of thought and deed would tend to result in the development of an excellent staff.

In addition, every assistant should continue his studies by means of professional literature, lectures, etc., and always strive to learn and know more than is necessary for the work required of him, since by that means alone he is able to fit himself for a more responsible position.

Omitting many other points, one small one must be emphasized—viz., the initialling and dating of all plans, drawings, or documents by the assistants or clerks engaged thereon, and the checking and initialling of all calculations, quantities, and certificates, since it is so easy in the midst of the multifarious duties which devolve upon this department for a slip to be made, but so difficult to restore that confidence which all desire and endeavour to merit.

A reservoir with about 120,000 acre-ft. capacity will be built (shall we say, D.V.?), on the Glatzer Niesse, near Ottmachau, Silesia, Germany. It will be the largest reservoir in Germany, and its construction is expected to take five years. Of the total capacity, 20,000 acre-ft. will be reserved for flood control; for improving navigation on the river Oder, 70,000 acre-ft. will be provided, and it is estimated that in very dry years the river flow can be increased 2,000 sec. ft. The water power can be utilized by fixing the lowest water level in the reservoir. The dam will be about three miles long, and it will be the longest in the world. It will consist of an earth embankment with a masonry core. It has been found that one of the strata of the geological formation of the valley is a layer of clay, 25 ft. thick, extending up on both sides of the buffs, so that the whole reservoir is enveloped by an impervious blanket. The greatest depth of the reservoir will be 40 ft., and its area will be 5,000 acres.

Grass as a soil binder along the banks of large earthfills is discussed in the "Iowa Service Bulletin." Among grasses developing a good system of roots, as well as possessing ability to withstand the hot rays of the sun, the following are termed the best: Hungarian brome grass, hairy brome grass, Canadian blue grass, Fescue grass and Western wheat grass. Quack grass is regarded as a weed. Western wheat grass has unusual ability to grow on the sunny side of an embankment and may, moreover, be easily killed by cultivation. Planting and seeding are said to be equally successful, and, where it is desired to plant, sweet clover and creeping honeysuckle are recommended. These are especially useful in cuts.

Constructional Features of the Algoma Eastern Railway

THE new Algoma Eastern Railway, which has been built from Sudbury to Manitoulin Island, crosses Lacloche Island and Goat Island and reaches Manitoulin at Little Current, where it has its terminal at present. The railway crosses from Lacloche to Goat Island by a fill and a timber trestle, and from Goat Island to Manitoulin by means of a swing bridge across the main channel, and has its terminal station situated at the eastern end of the town. The station arrangements consist of a depot, 47 ft. x 22 ft., and a freight shed 50 ft. x 26 ft., both frame buildings roofed with shingles. The depot is built in an ornamental style and contains baggage and express rooms, office, waiting room and women's room, and abuts on a platform 250 ft. long. The freight shed has an office at one end 11 ft. x 26 ft., and has a dock outside extending along the front of the building, and 50 ft. beyond for unloading cars, while the roadway comes up to the rear of the building. Though the passenger station is on the town side of the channel, the yard and all the terminal arrangements are situated on the small Goat Island, which has been bought up by the company.

Little Current Bridge – View of pivot pier and fender crib.

The first piece of work undertaken was the foundation for the bridge, which was started early in 1913 and continued through the winter, the work being finished at the end of May last year.

The bridge has a central swing span, giving when open two clear channels of 150 ft., and has two shore spans at the north end 70 ft. each and one at the south end 65 feet long. All four piers and the two abutments are founded on the rock, which is at the surface practically, no excavation being necessary except for the abutments. The maximum depth of water at the pivot pier, which is the deepest, is 26 ft. The piers were constructed in open cofferdams built of square timber and caulked. These were framed on shore, towed to position, set, weighted with stone, and then filled with concrete under water by means of derricks and deep sea buckets. The under water concrete was brought up to a level 4 ft. below the water line, when the cofferdams were pumped out and the remainder of the work done in the dry. Small puddle dams were used for the abutments (which are in shallow water), consisting of two rows of sheeting driven, then filled in with puddle, and inside these the abutments were built entirely in the dry.

Owing to the rapidity of the current at the point where the bridge crosses, the channel is hardly ever closed in the winter, and consequently it was possible to set the cribs and to keep a tug at work through the winter. The operations were carried out in daytime only, but during the night the concrete work was covered up and kept hot by steam pipe while setting. The gravel and sand used for the concrete was also kept hot by pipes running through it and the water was heated by steam blown into it. The concrete work has in no way suffered from being built in the winter and its appearance and finish is very good. The pivot pier carrying the draw span is surrounded by a long timber rest pier, over which the bridge swings when open. This consists of six timber cribs 40 ft. long and 35 ft. wide, which were built on shore, towed to position, sunk, and then filled with stone. The cribs are built of round timber to 3 ft. below water level, and the upper structure is of square timber built continuously over all the cribs and bridging over the spaces between them. The end cribs are pointed and two wallings run the whole way round the pier provided with steel plates at the points and angles.

The steel superstructure of the bridge was ready for operation in December of last year. A timber trestle approach was built to the north abutment of the bridge, as it was not thought advisable to fill in behind the abutment until the concrete had had time to become thoroughly hard. This was built in round timber and was used for the erecting of the steel shore spans. The whole trestle has, however, been filled in by the ballast train, and the grade, which was 3 per cent. on the trestle, has been reduced to .8 per cent.

Arrangements have been made on Goat Island for dealing with large quantities of coal, and a coal dock 430 ft. long has been built. This dock is built up of round timber cribs 100 ft. long and 12 ft. wide, with short cribs at the ends running shorewards. The cribs were placed in position and filled in the same way as those in the rest pier of the bridge, and are built separately to 3 ft. below water level. Above that level continuous square timber construction is used and the finished dock level is 5 ft. above the water line. The timber used is B. C. fir, and two oak wallings run the whole length of the dock. Anchor logs 20 ft. long, bolted to the round timber cribs, extend behind the dock under the back fill to give added stability, as the water is shallow here, and after dredging the cribs stood on the edge of a small cliff. A track carried on 24-in. sq. stringers runs along the dock and there is another track 32 ft. distant, long timbers running from one track to the other. A third track is carried on a row of concrete pedestals on the island 5 ft. square and battered 1 in 6; this track also runs on 24-in. stringers bolted to the pedestals. The three tracks carry the traveller for unloading and storing coal. There is a height of 44 ft. below the level of the dump buckets, and the total space which the traveller can cover is

400 ft. by 284 ft., which gives a maximum capacity of about 80,000 tons.

A commercial dock has also been built in the same line as the coal dock and distant from it 605 ft. This dock is of the same construction as the coal dock, but it is planked at the top, and the anchor logs have been dispensed with, as the water is much deeper and the dredging consequently less. The back fill is brought right up to the floor level of the dock and on this a warehouse has been built 80 ft. x 36 ft. for dealing with freight. This is a frame building covered with corrugated sheeting and roofed with Brantford roofing. Practically the entire floor space is devoted to freight but a small office 16 ft. x 18 ft. is provided at the west end. The building is on cedar posts and has its floor level 3 ft. 10 in. above dock level, while a track runs behind the building, enabling freight to be readily transferred from train to boat or vice versa.

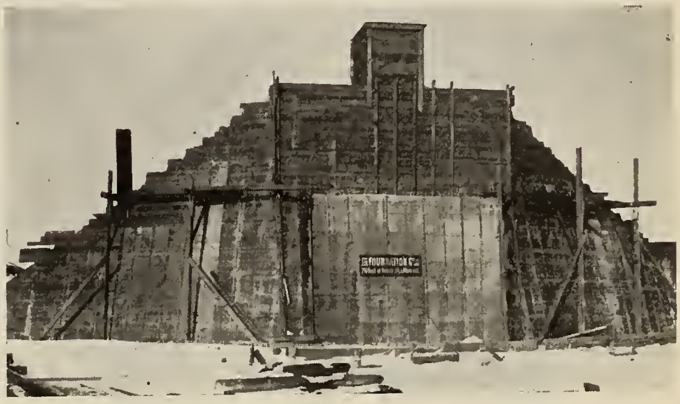
The channel along the front of both docks was dredged to a depth of 22 ft., the former depth varying from 6 ft. to 20 ft. The rock was drilled and blasted and then removed by means of a dipper dredge. In the first place the rock was not taken out close up to the dock, but the last cut was taken out afterwards, so that the rock could be blown to an open face to avoid any chance of undermining the cribs.

An engine house has been built at the west end of the island with accommodation for four locomotives. This building is of frame construction, 112 ft. by 96 ft. on a concrete foundation, the three rows of 10 ft. x 10 in. posts carrying the roof being also carried on concrete piers. Four engine pits are provided, built in concrete with a fall toward sumps at their inner ends, and one of these pits is also provided with a drop pit for the removal of wheels and axles with a gantry carrying a three-ton hoist over it. As the engine house is also used as a repair shop efficient arrangements for heating have been made, hot air being the medium. In one wall of each of the pits is a corrugated galvanized pipe 15 in. in diameter, which has openings into the pit at intervals with registers, so that a supply of air may be turned into the pit at any point. In addition there are eight 8-in. standpipes and two 15-in. standpipes with registers placed in the building for general heating. The hot air is supplied by a heater and blower. The interior of the building below floor level is filled with gravel with a 5-in. concrete floor over it and this again is covered with brick paving. The track doors give openings 12 ft. x 16 ft., and have ribbed glass lights in their upper halves to give additional light to the interior. The building also contains a coal bunker and repair benches, the bunker having coal doors above it at such a height that coal can be thrown in from cars standing on a track outside. Arrangements have been made for heating cars standing on the track outside, for which purpose a 1½ in. steam pipe enclosed in a 6-in. tile pipe runs to a concrete box between the rails of the track, where it can be connected to the heating pipe of the cars.

The engine house is roofed with Brantford roofing and carries four Dickinson cast iron smoke jacks supported on timbers in the roof and situated over the inner ends of each pit 15 ft. above rail level. There are also two 30-in. Burt ventilators at the outer ends of the pits.

A Fairbanks-Morse coaling plant has been installed for coaling locomotives, etc., of 100 tons capacity. The cars discharge into a concrete hopper over which the rails run on girders, so that the cars can dump on either side of the track, and the coal then passes through a door at one side into a booth, from where it is lifted by a bucket elevator into the coal pocket above, from which it can be discharged to locomotives by means of a chute. The entire pocket is carried on a balance, and by reading the weight before and after discharging the amount of coal issued can be ascertained. The plant is operated by a gasoline engine driving through a rope. There is a cinder pit near the coal plant for locomotives discharging cinders and ashes. The locomotive runs over a pit, one rail being carried on a girder supported on C. I. Standards and discharges its ashes beneath on to a concrete floor. At the side of this is a still lower pit into which cars can be run down an incline and the ashes can then be shovelled on to the cars in a very short time.

The water supply to the yard is dealt with by a combined Fairbanks windmill and water tank having a capacity of 50,000 gallons. From this tank a ten-inch main takes water to a ten-inch standpipe for watering locomotives, the standpipe being built in a concrete box. A 2-in. water supply to the coal plant and cinder pit for washing purposes is also taken from this ten-inch main. A four-inch main supplies water to the engine house to two hydrants and the boiler, and also to a fire hydrant outside the building. The tank is normally kept full by the windmill pump, which takes its water from the lake by a four-inch intake provided with a foot valve. In the event of the wind being insufficient a combined gasoline engine and pump has been installed in a small pump house for emergency purposes. The intake has been protected from damage by logs or ice by a guard crib built round it where it enters the lake.



Little Current Bridge—North abutment.

A complete drainage system has been put in, the surface water being taken from sumps at the coal plant cinder pit and standpipe by a 6-in. vitrified pipe which joins the drainage pipe from the sumps in the engine house pits and drop pit, the two pipes then discharging into an 8-in. vitrified pipe which falls to the lake. A trap is provided outside the engine house to prevent any gases passing into the building.

As the island is practically solid rock it will be seen that a large amount of rock excavation was necessary both for the cinder pit and coal plant and also for the trenches carrying the pipes for drainage and water.

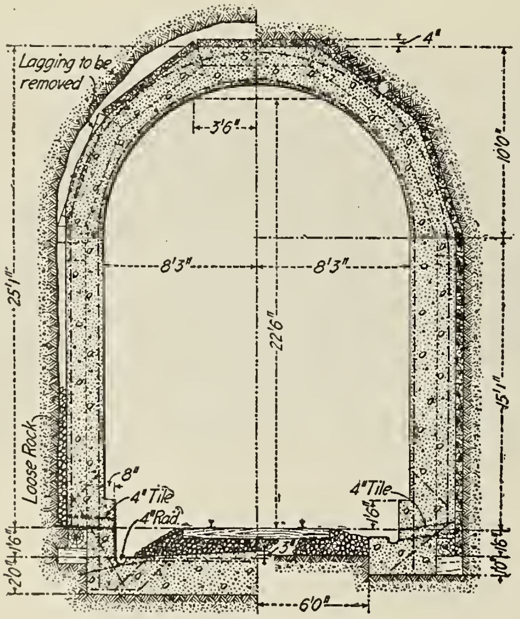
There are ample arrangements made for dealing with cattle in the form of pens both sides of the channel, and there is also siding accommodation for 120 45-ft. cars, and a Y for turning trains or locomotives.

The whole of this work, with the exception of the superstructure for the bridge and the coal plant, was carried out by the Foundation Company, Limited, of Montreal.

Tunnel Work on the Grand Trunk Pacific

Difficulties Encountered and Methods Employed in Finishing Nine Bores on the Transcontinental Line Through British Columbia

WHEN the preliminary work of driving the Grand Trunk Pacific tunnels in British Columbia had been completed "in the rough" and track laid so that construction and supply trains might pass on to the ever-advancing railhead there yet remained a difficult and expensive part of the tunnel work. This was the trimming up of the tunnels and the placing of permanent lining. On the line built eastward from Prince Rupert this work was started in September, 1912, and was not completed until February, 1914. It involved practically the same problems and difficulties that were met in driving the tunnels in the first place, with the additional factor of keeping the track clear for the passage of trains. There are eleven tunnels in this section of the road, of which two (Nos. 2 and 7) are in solid rock and required no lining. The remaining ones, which required to be lined with concrete, have a total length of about 6,500 ft.



Typical half-sections of tunnel lining.

Tunnel 1, at mile 44 east of Prince Rupert, was driven for use as a snowshed during the winter months, trains using the main line, which followed the contour of the hill outside, for eight or nine months of the year. The roof of this tunnel was found to be about 4 ft. too low to allow the placing of the lining which was finally considered necessary; but since the track outside could be used for traffic while the tunnel work was under way no great construction difficulties were experienced. The downhill side of the tunnel interior was also widened down to a level about 4 ft. above the track where the rock was benched and was used as a foundation for timber and concrete. About 30 ft. of concrete lining were required in the badly broken rock at the west portal.

At mile 103.7 the main line enters a 920-ft. tunnel, about half of which is in solid rock, and required no lining. At its eastern end, however, the tunnel emerges in material which is extremely troublesome when wet. One of the accompanying views shows the condition of the portal during the work, where, after many slides, timber cribs were built to prevent the mud from flowing over the track. It was decided that long wing walls would be required at the portal, and to secure substantial support for these a pile foundation was put in and the concrete was placed under the protection of a cofferdam. Although the soft material gave much trouble during the construction, once the work was completed it is said to have proved satisfactory in every way. The view of the completed portal indicates the successful operation of the subdrainage system.

Concrete-Mixing Plants

The concrete plant at this portal was arranged to be operated by two double-drum hoisting engines. One of these conveyed materials up an incline to bins over the concrete mixer, while the other handled cars loaded with concrete between the mixer and the desired point on the track. For use at this tunnel a temporary platform was fitted up on a standard flat car and provided with an incline leading up from track level. This was known as the "high car" and was moved from point to point in the tunnel, or drawn out for the passage of trains, by means of cables from the same stationary engine that operated the dump cars. When the dump cars had been charged at the mixers and conveyed to this "high car" at the point where work was in progress they were uncoupled and connected to a cable leading up the incline, operated by the engine as before. Thus the concrete was delivered at the desired point along the tunnel line on top of a platform high enough to allow it to be dumped into side wall forms or easily shovelled into the roof forms.

A typical plant for mixing concrete for tunnel lining is shown in the portal view of tunnel 4. This tunnel, at mile 104, is 550 ft. long, and the material traversed was so soft and broken that concrete lining was necessary throughout. Suitable space and materials for mixing concrete were found at the west portal, and the plant shown was therefore established there to supply the entire tunnel. Gravel was shovelled by hand into dump cars, shown at the left of the picture, which served as measuring boxes, each holding just enough for a batch. The cars loaded with gravel were hauled up the incline as far as the cement shed, under which they stopped long enough to receive the cement charge on top of the gravel, and were then hauled to the platform, where they were dumped into the mixer hopper as desired. The engine on the left of the track operated cars on the incline, while the one on the right hauled the concrete cars in and out of the tunnel. These cars operating in the tunnel used tracks laid on 12 x 12-in. timber framing shown, which had to be erected throughout the length of the tunnel to support loose rock and prevent a cave-in.

Difficulties in Relining

Perhaps the most difficult work on the line was in the 1,250-ft. tunnel at mile 104.5, which had to be timbered as fast as it was driven for more than 1,000 ft. of its length. All this original timber lining had to be removed to allow the final trimming up of the bore and the placing of the concrete lining. This proved to be dangerous work, because there was much loose rock behind the timbers. In this tunnel there was no alternate route, and the track had to be kept clear for the passage of trains. The method adopted was first to put in 12 x 12-in. angle braces from the side-wall posts to the tunnel floor just clear of the track. Excavation for permanent footings was then made, undermining the lower sills, while the angle braces carried the load. Concrete was then poured on foundations thus prepared and was left to harden with an offset for temporary timbering.

On the offset of the permanent footings temporary bents of 12 x 12-in. timbers were built, similar to those shown in the portal view of tunnel 4, these bents being of such size as to give sufficient clearance for trains and at the same time leave room for the lining-forms. The roof timbers were then supported on these temporary bents, while original posts, sills and wall plates were removed, and the forms placed and filled up to the springing line of the arch. In some places the nature of the material was such that it was safe to remove the timbering and pour side-wall sections as long as 48 ft. at a time, while in other parts of the tunnel the ground was so heavy that 4-ft. sections were as long as could be handled with safety. After the concrete walls had set the roof timbers were removed, a section at a time. The arch was concreted by a similar process. The roof sections gave more trouble than the walls, and the lengths deemed safe without timbering varied from 3 to 32 feet.

Concrete was handled in this tunnel by the use of a "high car" similar to that already described, except that here a short incline led from the "high-car" platform to the top of the temporary bents, from which concrete was dumped into side walls or shoveled into roof forms.

The reinforcing in the concrete lining varied with the material traversed, but a typical case in gravel and clay was given a double row of ⅞-in. round bars placed on 6-in. centres and extending from the footing on one side over the arch to the footing on the opposite side. The horizontal bars were ⅝ in. in diameter and were placed on 5-ft. centres. Splices were required to have a 4-ft. lap and be firmly wrapped with wire. Where soil conditions required, the invert was floored with concrete, or concrete struts 4 ft. wide were placed on 12-ft. centres.

The trimming-up and lining of tunnels 1, 3, 4, 5, 6 and 8 were under the supervision of F. R. Giertsen and that of tunnels 9, 10 and 11 under the supervision of G. C. Mulville, assistant engineers, Grand Trunk Pacific Railway. Contracts for all this work were held by the Bates & Rogers Construction Company, of Chicago and Spokane, for whom R. J. Graham was superintendent.

Sheet asphalt for the middle section of the street and brick pavement on the sides and gutters—is suggested by the City Solicitor of Hamilton, Ohio, as a solution of that city's paving problem. It is claimed that this type of pavement has proved successful in other cities.

The National Paving Brick Manufacturers' Association will hold their eleventh annual convention at Buffalo, N.Y., September 9-11 next. Mr. W. P. Blair, 832 Brotherhood of Locomotive Engineers' Building, is the secretary.

Mining Operations in Quebec

ACCORDING to the returns received by the Quebec Mines Branch, the value of the products of the mines and quarries of the province reached a total of $13,119,811 during the year ending December 31st, 1913. It is the highest annual production recorded to date and exceeds that of 1912 by $1,932,701, or a proportional increase of 17 per cent.

The structural materials appear for a preponderating part of the total value of the mineral production of the Province of Quebec. In 1913, their value amounted to $8,187,917, which represents 62 per cent. of the total production. Under this heading are grouped cement, limestone, brick, granite, lime, building sand, clay products (tiles, drains, pottery, etc.) in the order of their importance.

Cement.—The cement manufactured in the Province of Quebec is exclusively Portland cement. The manufacture of cement is now an exact science, and it is almost impossible to find a natural mixture of clay and limestone which will give the results expected from a Portland cement. The natural cement industry in Canada has been entirely replaced by the manufacture of Portland cement, in which the raw materials are mixed in fixed proportions, according to a strict chemical control.

The composition of Portland cement is therefore definite, and although the mixture of raw materials may vary within narrow limits, it should normally contain 75 per cent. of lime carbonate, 13 per cent. silica (soluble), 5 per cent. alumina, 1½ per cent. iron oxide (Fe_2O_3), and the remainder allowed for impurities, magnesium carbonate, alkalies and inert substances. The raw materials used in the Province of Quebec are Trenton limestone exclusively, for the lime constituent, and Utica shale, or Leda marine clay, for the argillaceous component. These substances are very abundant. All along the north shore of the St. Lawrence river deposits of both limestones and clays are common.

In 1913, the cement mills of the Province of Quebec shipped 2,881,480 barrels, valued at $3.361,292. In fact, the value of the cement production was over 40 per cent. of the total value of the structural materials. Ten years ago, in 1904, the recorded production of cement of our province was 40,000 barrels, valued at $66,000.

Limestone.—The limestone industry is well developed in the vicinity of Montreal, where quarries have been opened at Mile End, at Outremont, Cote St. Louis, Longue Pointe, Villeray, Sault-au-Recollet, on beds of the Chazy and the Trenton limestones, both of which are well developed in the Island of Montreal.

At St. Vincent de Paul, St. Francois de Sales, where a great deal of the limestone is produced, the quarries are in the Trenton. The same formation is also worked at St. Marie des Carrieres, Deschambault and Lachevrotiere, in Portneuf county, as well as at Beauport and Chateau Richer, immediately below Quebec. Trenton limestone is also quarried in Hull, opposite Ottawa.

From returns received from producers, the limestone extracted in 1913 reached a value of $1,704,207. This, however, does not represent the whole production, for it is almost impossible to keep track of all the small operators who work spasmodically. From the 162 names of limestone producers to whom we sent return forms to be filled in, only 84 answers were received, many answering only after the second or third request. Of these 84, there were 44 who reported a production, and 40 whose quarries had been idle during the year.

Granite.—The Laurentian area, which extends to the north of the Ottawa and St. Lawrence rivers, affords an unlimited supply of granites of various colours and textures, but owing to the limited market, very few quarries have been opened. The main operators in the Laurentian granite are the Laurentian Granite Company, whose quarry is situated at Staynerville, in the county of Argenteuil; M. P. and J. T. Davis, who are working a quarry at Riviere a Pierre, north of Quebec, the stone being used altogether in the construction of the Quebec bridge.

Another source of granite is found in the various igneous intrusions which penetrate the rocks of Ordovician age in the Eastern townships, and large quarries on such occurrences are worked in the township of Stanstead; in the township of Whitton; on Mount Johnson, near Iberville Junction. The production of granite reached $496,588 in 1913, as compared with $358,749 in 1912.

There are no new developments in the other materials of construction. Brick and lime show very small increases as compared with the previous year, which may be accounted for by the fact that concrete construction is on the increase, as shown by the large increase in the production of cement. The sand which figures in the table of production only represents a very small proportion of the sand actually used in building operations, as we only keep record of the sand which is worked under mining licenses. Most of this sand is dredged or pumped from the beds of rivers.

Garbage Incinerators and Destructors

By Sterling H. Bunnell, New York City

The author of this article is experienced in the solution of garbage disposal problems and here shows the fields of garbage reduction and of garbage and waste destruction. He then describes the processes in the modern English type of refuse destructor, with references to various plants in operation.

THE disposal of the garbage and refuse of cities is becoming one of the great problems of municipal life. In the early stages of a city's growth the rubbish and refuse is usually dumped in hollow places or on low lands, and serves as filling material. As the city increases in size the amount of refuse increases in proportion and land becomes less accessible from the thickly settled parts of the town. A rubbish dump creates a nuisance, is a menace to health, and a fire risk as well; while the dumping of garbage along with refuse increases the nuisance ten-fold. The garbage disposal problem generally comes up as one of the serious questions before the city authorities long before the city has grown to what may be called large size.

The waste of cities may be divided into three classes: Garbage, comprising putrescible refuse, table scraps, commission house offal and other waste from food substances, to which is occasionally added the carcass of a dead animal. Ashes from house fires and factory furnaces are produced in large quantities, and comprise the only form of city waste which can be safely used in filling low ground. Ashes can also be used to some extent in road surfacing in the suburbs. The third class of waste is dry rubbish, comprising waste wood, sweepings, lawn cuttings, branches from shrubbery, paper, rags, old shoes and other cast-off articles.

The three classes of waste, if obtained in sufficient quantities, can be advantageously treated separately. In cities of large size, where the class of garbage alone amounts to one hundred tons or upwards per day of twenty-four hours, the reduction system has many advantages. The garbage is collected in steel wagons, delivered to a reduction plant situated at a proper distance from the thickly settled portions of the city, and there converted by cooking and pressing processes into grease and tankage. In these operations a large quantity of stick-water is produced, which, if allowed to run to waste, creates a nuisance and is extremely unsanitary and objectionable. In order to dispose of the stick-water, which carries a considerable percentage of material which can be recovered as tankage, it is necessary to provide evaporators and to drive off the water as harmless steam, while the stick-water is concentrated into thick tankage and added to the product of the plant.

The products of a reduction plant are: grease, which may be classified, refined, and separated into various grades and sold for making soap and for other purposes; and tankage, which is useful in manufacturing fertilizer. If the operation is carried out on a sufficiently large scale, stated above to be not less than 100 tons per day, the profit is likely to be sufficient to make an attractive return on capital. In smaller quantities the reduction operation is almost sure to show a loss, unless all attempt to carry on the process inoffensively is abandoned and the foul and putrefying stick-water allowed to run away in the nearest stream. Small cities operating reduction plants are invariably burdened with a serious nuisance, as can be readily verified by inquiry among the inhabitants of such places.

The situation with regard to disposal of municipal wastes came to a crisis in Europe some years ago. In consequence, the most advanced methods of waste disposal originated across the ocean. The inhabitants of European cities waste far less of their food material than is the practice on this continent, so that the quantity of garbage per inhabitant is extremely small, and its value for reduction purposes is slight. There being no incentive, therefore, to separate garbage from other wastes, the plan was adopted of destroying the mixed refuse of the city in large high-temperature furnaces. The English destructor system by which the entire waste collection of a city, or a portion of the city, is delivered to a destructor plant, and there burned under forced draft, in connection with steam boilers by which power is obtained from the waste heat, has now been widely adopted by cities throughout the world.

Many of our cities have as yet done nothing in the direction of the sanitary disposal of municipal waste. Owing to the large free spaces which surround the smaller cities, it has usually been possible to carry on dumping operations, or feed the garbage to pigs, and to change the location of dumps when conditions become unbearable. Comparatively few of the smaller cities have been forced to instal incinerators for destroying garbage, or reduction plants for utilizing its values. But the time has already come when the conditions have become so serious that many cities are studying the best solution of the waste disposal problem. Since the reduction plant cannot be operated on a small scale without nuisance, except at a heavy cost for operation and maintenance, the simplicity and convenience of the incinerator makes the latter the only feasible apparatus for waste disposal in small cities.

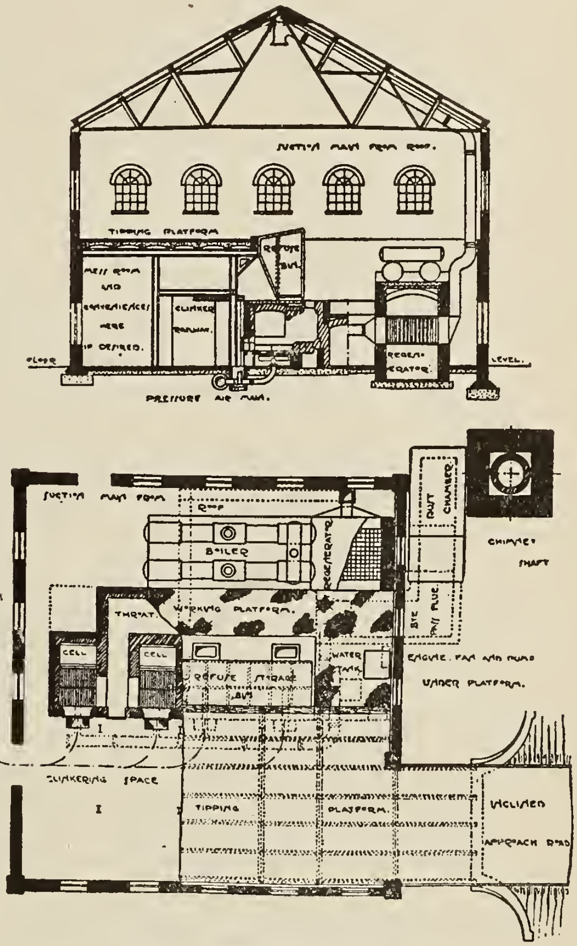
Incinerators are intended to deal with garbage and rubbish as collected, and not to handle ashes or large quantities of non-combustible material. Two kinds of incinerators may be recognized. One attempts to provide storage space within the furnace for the entire day's collection of garbage, and to dry the wet mass slowly by heat previously accumulated in the furnace walls, and supplied by a coal or oil fire kept up in a combustion chamber below the material. The system has the advantage of taking the entire day's collections at one time, thereby reducing the time and labor at the plant. Its disadvantage is the impossibility of maintaining in the presence of the mass of wet material temperature sufficient to destroy the noxious odors. Incinerator plants of this character should be provided with tall chimneys, and are never safely located within the limits of a settled portion of the city.

Incinerator furnaces operating at high temperature have been successfully installed and operated in a number of cities. Such furnaces are constructed of fire-brick throughout. They provide a fire-brick surface on which the garbage and refuse may be charged in reasonable quantities at intervals of thirty to sixty minutes, and a fire grate on which quick combustion, at high temperature, may be kept up by firing the dry rubbish collected along with the garbage, or using coal or other fuel if the quantity of rubbish is deficient, or the collection too wet on account of rain. In the brick-lined destructor furnace it is possible to keep up a temperature above 1,250 degrees, and thereby to destroy organic gases and positively prevent the escape of disagreeable odors from the plant.

Destructor furnaces may be used in connection with steam boilers, if desired, and steam power may thus be developed for any useful purpose. In this way large department stores and city buildings may utilize the waste material which is collectible in large quantities, and supply steam to the power plant of the building. Large works may dispose of rubbish of all kinds, including sweepings, restaurant scraps and every form of combustible waste, whether wet or dry, while realizing from the waste heat a large amount of steam power. In cities and towns up to populations of 25,000, destructor furnaces with steam boilers in connection, may provide power for municipal lighting, for sewage pumping, or for the heating of city buildings and other useful purposes.

Where the quantity of rubbish and garbage collected reaches upwards of one hundred tons per day of twenty-four hours, the English destructor system has marked advantages. The destructor receives and destroys all material collected, making it unnecessary to separate garbage from refuse and ashes, and requiring only one collection instead of three. The temperature at which the material is destroyed precludes the possibility of creating a nuisance in the neghborhood. In the City of London, the Borough of Bermondsey has a destructor installed in a city block containing a school, a city building, a library and a number of residences, and surrounded by closely built blocks of residences on three sides. This particular destructor is now operating after some fifteen years use, at greater capacity than originally intended and is receiving the refuse collections from an adjacent borough as well as its own regular collections.

The high-temperature destructor consists of two or more separate cells or furnaces, each provided with a grate and a drying hearth at the rear. The forced draft is supplied to each cell by a perforated air pipe opening in the ash pit. The gases of combustion pass through the cells from one to the next and enter a combustion chamber, in which the temperature may go as high as 2,500 degrees. From the combustion chamber the gases are led through the heating passages of a steam boiler, thence through a regenerator or air heater and to the stack. The air for forced draft is taken generally from the roof spaces of the destructor house, thus providing efficient ventilation and means for the removal of dust. The ventilating ducts lead to the intake side of a pressure fan, by which the air is forced through the heating passages of the regenerator and thence through air pipes controlled by convenient valves to the perforated discharge pipes under the grates.



Plan and cross-section of Sterling refuse and garbage destructor at Berkeley, Cal.

In the operation of a destructor, the garbage, refuse and ashes, mixed as received from the collecting wagons, is fired, either through charging holes in the top of each cell, closed by sliding covers lined with fire brick, or through doors in the back wall of each cell. The damp material falls on the drying hearth referred to previously, and is acted upon by the heat from the material burning furiously on the grate surface in front of the drying hearth. In this way vapor and fumes are driven off and consumed thoroughly in the passage through cells and combustion chamber. As the material on the drying hearth becomes dry, it takes fire and commences to burn rapidly. The stokers now pull forward the charge from the drying hearth and spread it over the grates, and introduce a new charge of fresh material upon the drying hearth.

The cells are operated alternately, so that one is always burning brightly while another is being charged. In this way there is always sufficient heat and flame to destroy the escaping odors and vapors. As the material burns on the grates it forms a hard clinker, which must be removed from time to time by stoking.

Mechanical charging and clinkering devices have been developed with more or less success, for use in the larger plants. The most convenient method for stoking the garbage into the furnaces is the top-feeding system. The building for this method is preferably constructed against a side hill, on which a road can be laid giving access for wagons to the second or dumping floor of the building. The garbage in this way is dropped into hoppers above the furnace and raked from these hoppers into the charging cells as required. During the operation of charging, the blast must be shut off from the cell being charged, or flames may issue from the charging hole and ignite material in the hopper. To prevent such accidents, and for greater convenience in charging, mechanical charging mechanism has been developed, by which material required for one charge of a furnace is first placed in a container or bucket, which at the proper time is moved over the charging opening, the cover of the opening withdrawn, and the material allowed to fall into the cell below without handling or delay.

Where the top-charging system is not convenient, because no side hill is at hand and an inclined runway is not wanted, the garbage carts may dump on the floor level of the building, and the material may be carried by a grab bucket and crane from the receiving hopper to the charging containers above the furnace. A simpler method is to dump each garbage cart into a skip running on an inclined track. After receiving a load of garbage, the skip is hoisted by machinery to the top of the building and there dumped into a charging hopper, from which it is raked into the furnaces as required.

Clinkering a destructor furnace is generally performed by hand, and is an extremely difficult operation to perform by machinery. Destructor furnaces commonly receive all kinds of waste materials, including pieces of wire, nails, glass, iron rods and other articles which often lock in the grate spaces or melt and run into solid masses of clinker, difficult to dislodge except by direct attack with a slice bar and poker. One method of mechanical clinkering is to provide the furnace with grates constructed in the form of a trough, and to lay in this trough a zig-zag iron bar which will become incorporated in the mass of clinker. When a large body of clinker is formed, a wire rope from a small windlass is hooked to a ring in the end of the bar and the whole mass drawn forward out of the furnace onto a steel car and thereby taken out of the building. Another method of clinkering is to provide a hydraulic plunger in the back of the furnace. By moving the plunger forward, the mass of clinker will be lifted and shoved out of the furnace to fall in the clinker car. Various forms of dumping grates have also been tried. But, at the present time, none of the mechanical systems of clinkering is in successful operation in the United States. The difficulties in the way of clinkering mechanism, through the presence of foreign substances in the clinker, and the general difficulty of removing heavy masses of molten clinker and ash, have been insurmountable.

Destructor furnaces of the English type are in operation in a number of cities on this continent, among which may be mentioned Montreal and Halifax, the borough of Richmond in New York, Paterson, N.J., Pittsburgh, Pa., Berkeley, Cal., and others. There are several large plants under construction or test, and the use of the system will undoubtedly increase rapidly in the near future. Many cities are inquiring to-day for information regarding the plants already in operation, and much interest has been aroused by the performances of the many successful plants.

A destructor plant, housed in a neat and handsome building, is a source of pride to the municipality owning it. No nuisance whatever occurs from the operation of such a plant, if well managed. Deterioration is not rapid, nor is the apparatus complicated and difficult to handle. Ordinary laborers are easily taught to be successful stokers in such plants. By proper planning in advance, a destructor plant may always be located on a site conveniently near the centre of the collection district and at a point where the steam produced, or electricity generated by engines operated with the steam from the destructor boiler, may be used by the city or sold to adjoining private parties. In many cases the operation of destructors is found to be a source of profit sufficient to cover the cost of collecting garbage. As between the filthy and unsanitary method of dumping the garbage and rubbish collections on vacant lots, or feeding pigs in municipal pens, and the efficient and sanitary disposal of rubbish and garbage in destructor plants, the choice is all in favor of the destructor system, and this system is the only one which can afford a profit in cities of moderate size.

The larger cities, in which the collection of garbage alone reaches seventy-five to one hundred tons a day, may with advantage consider the establishment of three collections, and the separate disposal of garbage, ashes and combustible rubbish. In these cities, a destructor finds employment for burning the unsaleable waste rubbish, as in the cities of Pittsburgh and Buffalo. Ashes being disposed of by dumping, and garbage by shipment to a reduction plant, the remaining rubbish can be sorted over a picking belt and separated into salable and unsalable portions. The worthless rubbish burned in high-temperature destructors furnishes power for the operation of the picking belt, and a surplus of electricity for lighting and for sale to other plants in the neighborhood. A further economy is possible. This is to utilize the worthless combustible refuse for furnishing heat to the reduction plant. This may be done either by baling the worthless refuse after sorting, and shipping it to the garbage plant, for which purpose it would be worth as much as coal at $2 per ton; or by delivering all the rubbish to the reduction plant, and there picking out the salable portions. In the average city collections, there is enough heat obtainable from the rubbish to provide most of the heat necessary in the reduction operation.—Municipal Engineering.

Calcium Hypochlorite as a Water Disinfectant

By E. J. Tully, Chemist, State Hygiene Laboratory, University of Wisconsin, Madison, Wis.

In a study of the effects of calcium hypochlorite upon water when used as a disinfectant, the author experimented upon the clear public well water supply of Madison, Wis., the waters of Lake Mendota, Michigan, and Winnebago, with varying degrees of turbidity and pollution. He also tested the amount of hypochlorite which would leave a taste or an odor in the clear city water and in Lake Mendota water, using the testimony of several persons on various samples after various periods had elapsed, 1 to 48 hours after treatment. The summary and the conclusions he draws from these experiments are as follows:

Chemical disinfection offers a means whereby a very satisfactory purification of a water may be accomplished. Comparisons on a cost basis of the methods of chemical disinfection mentioned make it apparent that calcium hypochlorite is the most satisfactory and efficient agent at the present time for water disinfection.

The amount of organic matter in the water practically determines the quantity of calcium hypochlorite that it is necessary to use. As a general rule, practical sterilization may be accomplished by the application of from 0.1 to 1 part per million of available chlorin, but occasionally concentrations of 2 and 3 parts per million of available chlorin are necessary to effect desirable results with rather highly colored and turbid waters.

The removal of B. coli and intestinal organisms is usually more complete than that of the total organisms. Under the conditions of the laboratory experiments, the results of hypochlorite disinfection on typhoid organisms and intestinal bacteria in the various waters were practically identical. It is, therefore, safe to assume that the viability of pathogenic bacteria under working conditions in practical water disinfection is no greater than that of the typhoid organism, or intestinal bacteria as a whole. Consequently, the disinfection effected by calcium hypochlorite relative to the total bacterial removal may be referred directly to pathogenic bacteria with assurance of reasonable accuracy.

The slight odor and taste of chlorin imparted with somewhat more than 0.5 part per million is applied disappears in a short time, leaving the water entirely acceptable from a sanitary standpoint, and, as the hardness is not materially increased by the application of the usual small quantities employed, the treated water is not rendered unsuitable for industrial purposes.

There is no apparent reason for believing that the results are not of general applicability. The reactions involved are particularly free from interference on the part of the mineral constituents of normal waters; and normal variations of temperature have practically no effect on the final results. The efficiency of the process is also entirely independent of the secondary or after growth of harmless resistant organisms.

The calcium hypochlorite process of sterilizing water combines the desirable qualities of economy and efficiency, and affords cities and towns, which are unable financially to build a filtration plant, but are forced for sanitary reasons to adopt some method of purification, a means of insuring a safe water supply. It may be used to advantage in cases of emergency, where either filtered or unfiltered supplies have become infected and where it is difficult to cease using such supplies. Where mechanical filtration is not sufficient to render a water safe, treatment with calcium hypochlorite offers an excellent method of sterilization and is especially applicable in such cases.

July Building Returns Show Increase

The building returns to date point to the fact that the volume of construction work planned during July was in the majority of cases greater than it was for the corresponding month of last year. The value of permits in Montreal was nearly a million dollars higher than in July of 1913 and brings the total for the year to date to over eleven million dollars. Toronto's figures ($2,320,835 for July, 1914, and $3,922,911 for July, 1913), on the other hand, were smaller than the exceptional record twelve months ago when two permits alone involved over two million dollars. At St. John, New Brunswick, only eighteen permits were issued, though the value of the buildings planned was over a hundred thousand dollars. Other cities in the Eastern provinces which passed plans representing a greater value than last year were Maisonneuve and Hamilton. Only a few returns are as yet to hand from the West and of these Winnipeg reports high figures—nearly double of those of last year. Regina is the only other city to show any substantial increase.

A wagon-loading machine for dry brick clay is employed by the Hydraulic-Press Brick Company, of St. Louis, Mo., in gathering the clay for its plant. Special plows hauled by traction engines turn up the top of the field to a depth of 1½ ins., the teeth of the plow being so set that each turns up a strip about 4 x 1½ ins. This strip curls over and breaks into pieces 4 to 8 ins. long as it falls from the plow. The entire field is plowed in this way and left to dry for 12 to 24 hours, according to the weather. The wagon loader has a four-wheeled wagon bed, surmounted by an enclosed vertical frame or tower within which works a vertical bucket conveyor, having long buckets. The lower end of the conveyor comes close to the ground and just in front of it is an apron which gathers up the clay so that it is within reach of the buckets. At the top, the buckets dump their contents into an inclined chute projecting from the side of the tower and discharging the clay into wagons which are driven alongside the machine as it travels across the field. The elevating conveyor is driven by a sprocket chain from one of the rear wheels, and the machine is hauled by a team of six mules. The plows and wagon loaders are of the company's design and are built in its own shops.

Erie, Pa., metered 31.3 per cent of the water consumed in 1913, which amounted to 144 gal. per capita for the 80,000 people served through 18,091 taps. Bacteria, according to the annual waterworks report, in water treated with 7.35 lb. per million gallons averaged 37 per cubic centimeter with maximum and minimum months of 60 and 18. Odor gave trouble only once, and that due to chilled water in December causing a slow reaction. 8he turbidity of the water settled one and one-half days varied in monthly averages from 4 to 33 parts per million, a removal of from 20 to 46.6 per cent.

Sewage Disinfection in Actual Practice

Observations Based on the Operation of Twenty Plants in New Jersey Using Calcium Hypochlorite as a Disinfectant

By William J. Orchard*

DURING the last six years the disinfection of sewage and sewage effluents as a practical form of sewage treatment has come to be adopted by a great many towns and municipalities. The growth of this form of treatment has been rapid, and present indications tend to show that its growth will be even more rapid in the future.

Much of the credit for the development of this process is due to Prof. Earle B. Phelps, now connected with the U. S. Public Health Service, who demonstrated in 1907 and 1908 that calcium hypochlorite was a practical and economical disinfecting agent as far as sewage and sewage effluents were concerned. Prof. Phelps carried on very extensive experiments at the Massachusetts Institute of Technology, Boston, at Red Bank, N.J., and at Baltimore, and the results of this work are very ably presented in Water Supply Paper 229 of the U. S. Geological Survey, reproduced in a recent issue of the Engineering Record.

As a result of the pioneer work of Prof. Earle B. Phelps there are now twenty sewage-treatment plants in the State of New Jersey at which calcium hypochlorite is used as a disinfectant, and several more are under construction or planned. Of the plants in operation eighteen are for the disinfection of sewage that has received more or less preliminary sedimentation. One is for the disinfection of a contact-bed effluent, and one for the disinfection of the effluent from natural sand beds.

Some of these plants are visited by representatives of the New Jersey State Board of Health once a month and the others once every two or three months, so that every disinfection plant in the State is visited at least four times a year. A great many visits to these plants have led to the conclusion that in actual practice the disinfection of sewage presents difficulties not encountered in experimental work and probably not appreciated by the casual observer. These difficulties are not due to any inherent defect in the process but are directly attributable either to faulty design or to improper or unintelligent operation.

Purpose of Disinfection

Sewage disinfection is resorted to generally as a practical and more or less economical means of preventing undue pollution of either water supplies, shellfish beds, or bathing beaches. If the disinfection is irregular and unreliable and does not destroy within the limits of practical disinfection the pathogenic bacteria in the sewage, the disinfection plant has fallen short of the purpose for which it was installed, and the consumers of the water, the shellfish, and the bathers at the beaches are unduly exposed to disease. That many of the disinfection plants at present in operation do fall short of the purpose for which they were installed is a regrettable fact.

Most of the trouble seems to be due to the shortsightedness of the designing engineer in not first experimenting with the sewage to be treated, and so designing the plant that the period of contact between the sewage or sewage effluent and the disinfecting agent will be sufficient to secure a reasonable bacterial reduction when a reasonable amount of disinfectant is used. Another reason for these plants not coming up to expectation is because as yet there has not been designed a dosing device that under actual working conditions is dependable and at the same time flexible enough to increase or decrease automatically the flow of hypochlorite solution as the flow of sewage increases or decreases.

Proper Period of Contact

To illustrate these two points, a description of the conditions found to exist at a plant spoken of here as Plant A is given. At this plant the hypochlorite solution is added to sewage receiving such a short preliminary sedimentation that it might almost be spoken of as crude sewage. To this sewage it was planned to apply sufficient hypochlorite solution to secure a dose of 13 parts per million of available chlorine, and a short supplementary contact period was provided for. The purpose of applying the disinfectant was to protect shellfish and bathing beaches. The hypochlorite solution is applied through a patented device in which the dose depends upon the depth of immersion of a small rectangular orifice in a constant level dosing box. This depth of immersion increases with an increase in the amount of sewage arriving at the plant. The device is not dependable, however, because the orifice is so small that it becomes readily clogged by particles of undissolved bleach and by pieces of the scum or scale which sometimes forms on the surface of a tank of hypochlorite solution. At one visit it was found that the orifice became clogged six times within one hour, and until the clogging was removed the flow of hypochlorite solution cease. Under these conditions it was determined that the dose of available chlorine instead of being 13 parts per million was 2.3 parts per million. By means of dye it was demonstrated that only 4½ minutes elapsed from the time the disinfecting solution was applied to the sewage until the sewage was discharged through the outfall into the stream. At every visit B. coli by the presumptive test has been indicated in 0.001 cu. cm. of the discharged effluent and in some cases in 0.0001 cu. cm.

Insufficient Operating Directions

At some plants much trouble is due to the designing engineer leaving the plant upon its completion without giving proper instructions regarding its operation. A case in point is Plant B, a relatively new plant embodying some commendable features of design. It is so arranged that the hypochlorite solution may be added to the sewage in its crude state, or after periods of sedimentation ranging from 1 to 4 hours. It is a very flexible installation, from which exceptionally good results can reasonably be expected.

The designing engineer left the plant upon its completion without giving directions regarding its operation. The local sewer committee appointed a member of the city police force as the attendant of the plant and he was required to visit the disinfection house twice a day, mix up the bleach solution and keep the pipes and orifices free from deposit. About six weeks after the plant was put into operation a representative of the State Board of Health visited it and found that the hypochlorite solution, instead of being added to the sewage, was flowing through a series of petcocks into a trough connecting the various sections of the sedimentation tank. The outlets from this trough were all tightly closed by stop-planks and the hypochlorite solution was simply storing up in the trough and absolutely no disinfection was accomplished. All of the bleach that had been used in the previous six weeks had been wasted.

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* Assistant Sanitary Engineer, New Jersey State Board of Health, Trenton.

Machinery in Disinfection House

Another difficulty often encountered at disinfection plants is due to the designing engineer placing pumping machinery in the disinfection house, where it is exposed to the corrosive action of calcium hypochlorite fumes. Any article of iron or steel which comes in contact with these fumes rapidly disintegrates and in a relatively short time must be replaced. Conditions found at Plant C illustrate this point. This plant is an installation for applying hypochlorite solution to a sewage that has received very satisfactory sedimentation and was built to protect shellfish beds. There is a high and low level sewer system, and the machinery for lifting the low-level sewage up into the sedimentation tanks was placed in the building in which the hypochlorite was stored, mixed and applied to the sewage. This machinery consisted of electric motors, gas engines, displacement pumps, air compressors, ejectors, etc.

The low-level system was not put into use until the plant had been running for more than a year, due to a broken trunk sewer under a stream. This sewer was repaired and the low-level sewage arrived at the plant. It was found, however, that the machinery could not be started, and an examination showed that every exposed part of each unit had corroded to an unbelievable extent. Even the leather belts had become so hardened that they split when bent, and in some cases gaskets, bushings and washers had entirely disintegrated. The low-level sewage was rapidly backing up throughout the system, however, and after a liberal application of oil the electric motors were started, with the result that they both were burned out. It was necessary to bypass the low-level sewage for several months before repairs could be made, and the machinery had to be housed in a separate building.

Ignorance of Plant Attendants

Lack of ability and knowledge on the part of the plant attendant is responsible for most of the troubles at disinfection plants. Municipal officials seem to have the idea that sewage disposal must be associated with dirt and stench and filth and that a common laborer is the man to take care of a plant.

The need of intelligent, trained attendants at all sewage-disposal plants is growing more apparent daily. Particularly is this so in the case of disinfection plants. At these plants a man must be on the job every day to mix the hypochlorite solution, clean the dosing apparatus, and keep the plant in working order. At a sewage-disposal plant of any other type a man might occasionally take a day off without seriously affecting the operation of the plant. At a disinfection plant, however, the least neglect always causes trouble, for either the hypochlorite solution will become exhausted or the dosing device will become clogged, and in either case disinfection ceases.

To illustrate the ignorance of plant attendants the following conditions found at plant D are described. Plant D is a disinfection plant installed for treating a sewage effluent which is discharged into a water supply that is filtered before it is distributed to the consumers. The necessary daily amount of calcium hypochlorite to be used was determined as 30 lb. The attendant was advised to mix the solution daily and keep a constant flow. A subsequent inspection showed that the attendant carefully weighed out 30 lb. of hypochlorite every morning and dumped it into the mixing tanks. He then opened a spigot to fill the tank and at the same time opened the outlet. Water was allowed to run into the tank continuously, with the result that the bleach was soon dissolved. In the early morning the dose of disinfectant applied to the sewage was excessive, but it gradually reduced throughout the day until in the afternoon it was negligible. Tests made at noon showed B. coli to be present in 0.01 cu. cm. of the final effluent.

Politics and Sewage

To further illustrate the carelessness of plant attendants and the effect of municipal politics upon the operation of sewage-disinfection plants a description is given of conditions found at plant E.

This plant was installed to protect shell-fish beds, and the hypochlorite solution is added to a well-clarified sewage effluent. At the time the plant was put in operation the superintendent of sewers was not a trained man and he assigned a street laborer as the plant attendant. He was allowed one hour in the morning and one hour in the evening to visit the disinfection house and mix up the hypochlorite solution. The flow of this solution is controlled by hand-regulated pet-cocks.

Shortly after the plant was put into operation an inspection was made, and it was found that the hypochlorite solution was all allowed to run out in a few hours and that for the remainder of the day no disinfectant was added to the sewage. At one visit it was found that the dose of available chlorine was 11 parts per million for 13 hours, but that for the remaining 11 hours of the day no hypochlorite solution was applied. While these conditions existed weekly inspections were made, but the importance of the matter was not appreciated by the superintendent and he refused to have the attendant take sufficient time to adjust the flow of hypochlorite properly. At many visits B. coli was found to be present in 0.00001 cu. cm. of the final effluent.

These unsatisfactory conditions continued for a few months and then a political upheaval occurred and a new superintendent of sewers was appointed. This man was a trained sanitarian who appreciated the importance of sewage disposal, and the operation of plant E under his supervision was greatly improved. The same laborer was instructed regarding the operation of the plant and was required to spend his entire time taking care of it. The dose of hypochlorite was regulated and the effluent was much more satisfactory. These better conditions continued for a year and then another political change occurred, the sanitarian was discharged and a new superintendent of sewers was appointed. He was not a trained man and took the same attitude as the sanitarian's predecessor, with the result that as far as the State Board of Health was concerned the work of securing proper operation had to be done all over again. At the last three inspections the dose of available chlorine has been 6, 2.3, and 4 parts per million, and in two cases B. coli was present in 0.0001 cu. cm. of the final effluent, and in one case in 0.00001 cu. cm.

Irresponsibility of Attendants

Another matter which enters into the operation of disinfection plants is the utter lack of appreciation of moral responsibility on the part of those in charge of the plant. For instance, plant F is an installation for disinfecting a contact-bed effluent. The final effluent is discharged into a relatively small stream, and 2 miles below the outfall is the intake of a water supply, which receives no treatment whatever. This is clearly a case where those in charge of the disinfection plant are morally required to exert their best efforts to protect the consumers of the water into which the effluent discharges. Repeated inspections have been made, however, when it has been found that absolutely no hypochlorite was being applied and B. coli was present in 0.001 cu. cm. of the final effluent. The superintendent of the plant has absolutely disregarded the requests and orders of the State Board of Health, and legal steps have been taken to compel him to operate the plant so that a satisfactorily purified effluent will be discharged. The process of the law is so slow, however, that a water-borne epidemic may break out in the town before the necessary legal steps have been taken. If such an epidemic should occur the negligent superintendent would certainly be morally responsible.

The cases cited are only typical of the general condition of disinfection plants. Almost every plant might be here described and used to illustrate some points of defective design or operation. George W. Fuller in the concluding paragraph of his book, "Sewage Disposal," says: . . . "If increased faithfulness is not given to the proper operation of sewage-disposal works it is only a question of time when steps should and will be taken by the State authorities in the more thickly populated sections of the country to make compulsory the proper management of sewage-disposal works."

Central Supervising Authority

With disinfection plants it surely is only a question of time, and the day probably is not far distant when the central supervising authority will be given more power to secure the discharge of a proper effluent and more workable laws to enforce this power. When this power is secured it will probably be necessary to adopt standards which the effluents must measure up to before discharging.

The adoption of such standards presents many obvious difficulties. As a basis of comparison the presence of B. coli in definite quantities of the effluent will probably be used, and the standard will be expressed as not more than a certain number of B. coli in a liter. If such a method is adopted no arbitrary standard could apply to every disinfection plant, and each case would have to be studied and a standard adopted in harmony with the controlling factors.

Among factors which should be considered in the case of an effluent discharging into a water supply might be mentioned the normal dilution afforded by the stream, the distance of the outfall from a water intake, and the measures taken to purify the water supply.

In the case of a disinfection plant discharging an effluent into water near shellfish beds it will be necessary, before standards are adopted, to determine the dilution factor and consider the stream or ocean currents tending to carry the sewage effluent to the shellfish areas. In the case of oyster beds, if the hibernation theory is accepted it will be necessary in every case to determine what allowance should be made during the season of hibernation, and when this season begins and ends.

'The whole matter of adopting standards for the effluents from sewage-disinfection plants is one that will probably not be developed for some time in the future. Until such standards are adopted, however, and more power is given to the State authorities intelligent supervision of sewage-disinfection plants will be a very difficult and discouraging problem. If designing engineers will recognize the difficulties encountered in operation and make their plans accordingly, and if the plant attendants will appreciate their moral repsonsibility much can be done to improve the present practice in sewage disinfection.

Oxidation of Sewage Without the Aid of Filters

IN a paper (by Messrs. Arden & Lockett) dealing with experimental work in the above field, read at a meeting of the Manchester Section of the Society of Chemical Industry, the authors arrive at the following conclusions:

(1) That the resultant solid matter obtained by prolonged aeration of sewage, which has been termed activated sludge, has the property of enormously increasing the purification effected by simple aeration of sewage, or, in other words, it greatly intensifies the oxidation process.

(2) The extent of the accelerating effect depends upon the intimate manner in which the activated sludge is brought into contact with, and upon its proportion to, the sewage treated.

(3) That, in order to maintain the sludge at its highest efficiency, it is necessary that there should not be at any time an accumulation of unoxidized sewage solids.

It is not necessary that the sewage should be kept in contact with the activated sludge until such conditions obtain, as its activity may be maintained by suitable aeration of the activated sludge alone.

(4) That temperature exerts a considerable influence on the oxidation process. The purification effected is seriously diminished at temperatures constantly below 10 deg. Cent. Up to 20—24 deg. Cent. no material difference in the clarification effect and general purification has been observed, although the nitrification change proceeds more rapidly as the temperature rises. At higher temperatures the clarification effect is somewhat interfered with during the earlier period of aeration, with a consequent delay in the establishment of nitrification. Subsequently the rate of nitrification somewhat increases.

(5) That, under the conditions of experiment, a well-oxidized effluent can be obtained by the aeration of average strength Manchester sewage in contact with activated sludge for a period of from six to nine hours. The percentage purification effected as measured by the usual tests is at least equal to that obtained by the treatment of sewage on efficient bacterial filters. The period of aeration naturally depends upon the strength of the sewage treated and the degree of purification required.

(6) That the activated sludge differs very consid-

erably in character and composition from ordinary sewage sludge. It is in a well-oxidized condition, and consequently entirely innocuous, can be readily drained on straining filters, and possesses a high nitrogen content.

The scope of this inquiry has been up to the present largely confined to laboratory investigations, and while the results obtained have shown conclusively that the purification process can be readily maintained, a large amount of further research is required in order to obtain a thorough knowledge of the character and mechanism of the changes taking place, which will be essential for the efficient control of the process.

The method employed in producing a satisfactory purification of sewage is, however, of so simple a nature that there would not appear to be any insuperable difficulties in translating the experiments described on to a working scale.

In view of the obviously great reduction in the area of works required and capital expenditure involved, the available data in regard to the probable cost of aeration is such as to lend encouragement to the idea that the adoption of aeration methods on the lines of these experiments would result in a considerable reduction in the total cost of sewage purification. In this connection it may be reasonably anticipated that the enhanced value of the resultant sludge should at least cover all costs incidental to its disposal.

Tar Treatment of Macadam Roads in England

Tar painting has been carried out in Lytham for the past nine years, this town being probably the first in the North of England to adopt it. Some 300 sq. yd. of the road along the sea front, which was an ordinary macadam road, were tried experimentally, half with limestone and half with granite chippings. The portion laid with limestone was for a time almost as dusty as ordinary macadam, but the granite, being a harder material than the limestone, was practically dustless when put on, and nothing but granite has since been used for tar-painted roads. When tar painting a new road an ordinary 160-gal. tar boiler is used, which is convertible into a sprinkler with gas piping perforated to form a spray; but for repairs a small 80-gal. boiler fitted with a pump and movable spray is chiefly used. A distilled tar is used for all macadam work, and for tar painting 1 part distilled tar to 1½ of crude tar. The tar macadam is better if it can be "hogged" for some time before laying, but in winter, on grounds of economy and convenience in handling, as a rule, tar is put on the roads the same day that it is mixed. The tar-macadam used is composed of stone from 2 in. down to ½ in.

From Ottawa comes announcement by the Government that there is no truth in the published statement that capital expenditures on public works are to be forthwith curtailed, in view of the war demands on the Dominion Treasury. The Government, in view of the accentuated unemployment arising from war conditions, intends to do everything possible to continue its constructional programme, thus providing work for thousands who would otherwise be in distress. It is stated that the Dominion's loan of $25,000,000 negotiated in June, will enable the Government to keep things going until the international financial situation clears.

A New Brick-Cleaning Machine

THERE has been invented by a Philadelphia, Pa., mechanic, a machine to clean used brick that will cut the cost to half or even a third of that of the old style method of cleaning by hand. It is estimated that the number of brick cleaned in that city in a single year is not less than 25,000,000, at cost of $1 to $1.50 per 1,000. This new machine will clean them for about 50 cents a thousand. The method of operation is to put the brick into the jaws in front of the machine, which grasp it and move it sideways over the corrugated surface. This cleans the end of the brick, and at the same time the two broad sides at top and bottom are cleaned for about two inches, back of the end. The partially cleaned sides are then inserted between two projecting opposed blades of a four-sided die and a plunger at the other end of the brick comes forward and pushes the brick through. The upper plate of the die is moveable and adjusts itself automatically to the thickness of the brick. The sides, as well as the bottom and top of the brick, are thus cleaned all at the same time. The machine is four feet long and weighs 400 pounds, so that it is readily portable. It is placed upon a platform or truck so as to be about breast high. It can be operated by either one or two men, and with an engine of 2½ horse-power its capacity is 15 bricks a minute. It can be adjusted to work slow or fast as desired. The commercial value of this invention lies in the fact that when by reason of the cost or because of lack of time, old brick are not cleaned—they are thrown away as useless. With the device these brick may now be saved. In New York 100,000,000 brick are now cleaned annually by hand.

Steel Production in the United States

Statistics of steel production in the United States during 1913 are summarized in Special Statistical Bulletin No. 5, issued by the American Iron & Steel Institute. Steel production in the United States in 1913 exceeded all previous records, being 31,300,874 tons. The production was, however, only 50,000 tons greater than in the year 1912. Almost exactly half of this steel was produced in Pennsylvania. Ohio came next with 6,700,000; Indiana and Illinois combined produced nearly 5,000,000 tons. The open hearth process of steel production now far exceeds the bessemer in volume of output. Last year the bessemer steel produced amounted to 9,545,000 tons, while the open hearth steel amounted to 21,600,000. The maximum bessemer steel production was reached in 1906, when 12,275,000 tons were produced. This compares with 11,000,000 tons of open hearth steel in the same year. Since then open hearth production has been increasing at a rapid rate, while bessemer has fallen off. The production of crucible steel amounted to 121,000 tons, while 34,000 tons were made in the electric furnace. The alloy steels produced amounted to 714,000 tons. The business of steel foundings has had a large development. Over 1,000,000 tons of steel castings were produced last year, which compares with 132,000 tons af steel castings in 1898. Nearly all the open hearth steel made is now made in basic furnaces. Only 1,255,000 tons of open hearth steel were made in acid furnaces. The total number of works manufacturing steel from raw materials is 304, located in 30 different states of the Union and in the District of Columbia and Panama.

Grouping and Penetrating Methods of Road Surfaces*

By George Green, M. Inst. C.E.†

THE ideal road would be one suitable for general traffic, which could be made in a satisfactory manner at less expense than an ordinary tar-macadam road, at a quicker rate, and independently of weather conditions, and which would last longer than a tar-sprayed water-bound road. Such a road would be within the more limited means of local authorities who are not blessed with too much money to spend annually upon their roads.

While the author does not pretend that he has found the long-looked-for means of satisfying all these requirements, he desires to draw the attention of the institution to some results which indicate how partial satisfaction may be obtained; but he more particularly hopes to be able to draw from other members additional information and experience on this subject which will be of advantage to those who have the somewhat thankless duty of making roads for the public with a too limited supply of funds.

It would not be out of place, and it might be helpful in considering this subject, to note a few points which the road maker is bound to consider, and which sometimes the road users and the public at large do not thoroughly appreciate. . . . . .

Provision must be made to keep road surfaces, where the gradients are exceptionally steep, with sufficient foothold for horses, and in frosty and muddy weather when the surfaces are greasy, an adequate supply of grit must be at hand. At the same time, these surfaces should be kept waterproof and as free from mud and dust as possible on account of the ever-increasing motor traffic. If motor traffic was all of one kind, a well tarred, sprayed, macadam would meet the case in many areas and for many miles of roads; but this traffic again is divided into various classes—e.g., heavy motor, light motor, vehicles driven by steam with broad rough tires and heavy loads.

These various kinds of traffic require special and often expensive treatment to keep our roads in a satisfactory condition.

This paper does not deal with main roads or county roads, but more particularly with secondary roads in towns and suburbs, which, at the same time, have considerable traffic, and occasionally are liable to have to carry all sorts and conditions of vehicles and tractors.

From a maintenance point of view it has been found that one of the most difficult roads to keep in good condition is the level road, which, on account of its want of proper longitudinal fall, particularly in wet weather, absorbs a large amount of moisture. Even a waterproofed road is more or less liable, partly owing to its position, to retain moisture in its foundations or in the subsoil if the district around is of a low-lying insufficiently drained character.

A road that has a good gradient is generally self-cleansing with every shower of rain, and has a chance of a much longer life, in addition to being more easily kept clean and in a satisfactory condition. The margins of roads where tram lines are in the centre will not be dealt with. These have caused enough anxiety, and will continue to do so, to their surveyors as long as tram lines exist, and must always require more or less special treatment. Another reason for calling particular attention to the grouting and penetrating methods is the great difficulty, which it is believed is not uncommon, experienced in obtaining the necessary supplies of tarred road materials of various kinds in the quantity and at the times when they are most urgently needed.

One frequently has the misfortune to have a long and important road undergoing reconstruction, and to be hampered and harassed with the difficulty of obtaining a sufficient quantity of these materials to continue and complete the work in anything like a reasonable time.

All these difficulties make it desirable and necessary for road makers to have more than one string to their bows, and to be able to turn to fresh sources of supply and to use various materials and methods when emergencies of this nature occur, in order to complete their road making and repairs in a reasonable time with as little inconvenience to the public as possible.

Two points that road engineers have to deal with must be emphasized: Road surfaces must not only be able to stand the suction which is the result of rapid motor traffic, with india rubber tires, which removes the dust, grit, sand, mud and water out of the water-bound roads, and sooner or later the small and then the larger stones themselves as they become loosened by disintegration, but consideration must be given to the provision of surfaces which will withstand the vibration from heavy vehicles—horse drawn, steam driven, and otherwise—which, with the continual hammering of the horses' hoofs and the solid iron tires, often shake the crust of the road and also its foundations.

It is obvious that a tar-sprayed road cannot last long under all these conditions. If the traffic were uniform, the problem would be simpler, and less expensive methods might be more easily adopted. All these points have to be considered in the construction or reconstruction of any road, and, as a rule, a road crust has to be constructed on such foundations as will be able to withstand all these conditions in a thoroughly satisfactory manner.

So far, difficulties common to all road engineers have been dealt with, among which that of an adequate supply of materials is by no means the least at the present time.

It no doubt arises largely from the fact that tarred materials of one sort or another have been recognized as one of the chief and best methods of road making, and road authorities—county, urban and rural—are all, without exception, making great efforts to meet the road problem of the day, and partly also on account of the fact that tarred materials can best be laid in dry weather, as most of these new surfaces and reconstruction of roads are done in the few months in the summer which can be relied upon as most suitable for this purpose.

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* Paper read at the annual meeting of the Institution of Municipal and County Engineers [Gt. Britain.]

† Borough Engineer, Wolverhampton, Eng.

If anyone can discover a material which can be used as satisfactorily in wet weather as in fine, or in winter as easily as in summer, no difficulty would be found in obtaining a ready sale for it.

It seems almost superfluous to reiterate here the great advantage of tar-spraying on well-constructed macadam roads. Most engineers have found that this is of immense advantage not only in the prevention of dust and mud in main roads subject to heavy and rapid traffic, but also that it adds considerably to the life of those roads, and is a distinct advantage from a health point of view in second-rate residential roads made of macadam in which many of the poor in our towns have to live. These streets often swarm with children who use them as their chief playgrounds. The sanitary advantage of tar-spraying in these roads can hardly be over-estimated.

Leaving the difficulties of the situation generally, stress must be laid on the great importance of having proper foundations and good drainage to all roads which are to be treated with waterproof surfaces and have to bear heavy traffic. Many roads which have for years been subject to heavy traffic have been found to consist almost entirely of a number of coats of macadam laid one upon the top of the other, the whole mass resting on a clay underbed without foundation or drainage of any kind. It is impossible for roads constructed on such lines to last, and in such cases the old macadam has invariably had to be removed, and below that, to the required depth, the surplus soil excavated and removed, and in its place a foundation of 6-in. or 8-in. slag pitchers laid upon a properly formed and well-rolled bed consisting of several inches of rough, hard clinker. The advantage of this layer of clinkers is to prevent the clay or underbed working through the pitchers towards the surface, and consequently causing the foundation to give way and become uneven. This usually forms an excellent drainage, and remains of lasting benefit to the newly constructed road. Upon this foundation several types of grouting or penetrating methods have been tried, the first which naturally suggested itself being that of ordinary tar. The first trial of this kind was made some five or six years ago on a road which had a natural and sufficient gradient longitudinally. There were tram lines in the centre, the whole surface on either side of the tram lines was scarified and regulated, and after that coated one stone thick with cold blast-furnace slag, carefully and sufficiently rolled in dry. After this a mixture of 40 gallons of gas-tar (not distilled), 6 cwts. of pitch and 4½ gallons of creosote oil, as the constituent parts of the grout, was poured on the surface through cans and rubbed in with squeegees; the surface was then coated with a thin layer of slag chippings and gently rolled in with a 10-ton roller, after which a second and thinner coat of the tar mixture was spread over the surface and another layer of finer grit to spread upon the top. This road surface, which is subject to a fair amount of traffic of various kinds, has lasted up to the present time with hardly any repairs except for trenches and occasional small repairs.

This class of road, provided it is constructed in dry, suitable weather, answers a very useful purpose, and, of course, is more lasting than tar-spraying and very little more costly than ordinary water-bound macadam, provided the same road material is used. Of course, a road of this kind could only be made in suitable weather, and should a period of wet weather follow the commencement of the work, completion might be delayed for a considerable time.

Experiments have been made on a similar form of road, with Plascom as binding material, with varying success; in some places the earlier work has stood for a number of years, and has a very satisfactory surface, in others there have been less satisfactory results owing to the heavier nature of traffic and to a level surface. A year ago a more elaborate experiment was made with this material. The road in this case was laid in two coats; the first coat was treated similarly to the one made of slag referred to above, and after it had been thoroughly grouted and rolled in, a second coat, one stone thick, of basalt was laid upon the top, and the process repeated with Plascom and chippings until the final surface was finished.

This was only done a year ago, and the length of its life cannot be estimated. The carriageway is narrow, the surface is a level one, with hardly any gradient, and the traffic of a heavy nature, mostly with iron tires, such as railway drays and vehicles of that kind. The surface today is almost as good as when it was laid down, but time alone can say how long it will last. Ordinary water-bound macadam in this road only lasts a year.

Roads grouted with Rocmac and with Glutrin have also been laid in an experimental manner, also with various results, but the latter experiments, made about twelve months ago, when the materials in both cases were mixed on boards in the form of concrete, have been much more satisfactory, and promise to make a more lasting surface, and one which affords at the same time a most excellent foothold for horses. The great advantage of these two materials is that they may be laid in wet weather even better than in fine weather, and consequently the work is not interrupted for any outside cause, as is the case with tar roads sometimes.

Plascom, Rocmac and Glutrin are more costly than Tarmac in the first instance, but the length of life has so far not been sufficient for a proper comparison.

Beyond the fact that Rocmac and Glutrin grouted roads can be constructed in winter, they afford a much better foothold for horses. A coat of tar dressing in the summer will prevent them being dusty, and add to the length of life generally.

A road was formed and treated with Bituvia on similar lines to Plascom and tar grout, and this, although only a year old, is also in good condition, and promises a fair life in the future.

There may be other forms of grouted roads equally good and useful, but there is still room for further progress in this direction, and the inventor, if the method be not an expensive one, might easily make a fortune. Most engineers would be glad to have a longer period, extending through the winter, in which to continue their road work, especially as sometimes it is difficult to find sufficient employment for all their good and useful men during the winter months when work is most needed.

A method of constructing a "noise-proof wall" consists of applying a coat of cement against a background of tar paper. It is stated that no loud tone of voice, pistol shot, or high note can penetrate the thickness of cement and paper.

Fraser River Development

The preliminary work of acquiring necessary data in connection with the preparation of plans for the future development of the North Arm of the Fraser River is progressing satisfactorily, and Messrs. Davis & Leslie, of Vancouver, consulting engineers for the undertaking, report that the results of the work done so far have been very encouraging. The jurisdiction of the North Fraser Harbor Commissioners covers the whole of the North Arm from the western boundary of New Westminster to Point Grey, a distance of about 17 miles, and includes the adjacent waters of the Gulf of Georgia over what is known as Sturgeon Bank. The test borings between Point Grey and the boundary of New Westminster (41 in number) have now all been completed, and with the exception of a couple of holes where a ledge of hard pan appeared at a depth of about 25 feet, the material throughout was proved to be of a nature well adapted for economical removal by suction dredging. It was anticipated that this would be the case, but definite confirmation was essential on a point so materially affecting the cost of the scheme, and this has now been obtained by carefully supervised tests.

Surveys of the shore and islands have been made, also observations of the river currents with soundings to correspond, while a complete series of soundings covering the whole work are now in progress, two parties being employed in this work. The results so far go to show that the North Arm has fully maintained its depth, and in some stretches is deeper than it was a few years ago.

Waterproof, Cleanable Whitewash

One pound of glue is dissolved in 3½ pints of water. To this is subsequently added three ounces of bichromate of potash dissolved in half a pint of hot water. These two ingredients are thoroughly mixed, and enough whiting then added to secure the right consistency. The mixture is applied to walls or roofs in the usual manner, and dries rapidly, while the action of the sun upon the potash and glue serves to render it waterproof.

Such a whitewash is available for a variety of applications both exterior and interior. It adheres firmly to slate, glass, metal, masonry, or plaster, care being taken, if on plaster, to rub it well in with the brush. It not only affords an excellent protection from the effects of the sun's rays in hot weather, but acts as an admirable waterproofing to walls exposed to driving rains. When desired, it can be cleansed with a hose and cold water, or washed with a sponge.

Hand Concrete Mixer Employed Successfully

A hand concrete mixer was used in the construction of the new combined concrete and timber snowsheds of the Great Northern Railway. While ½-yd. power mixers were used for the heavy work of the retaining walls or back walls, the hand mixer was used extensively in making the concrete for the pedestals which support the timber posts for the roof. This arrangement worked out very conveniently, as the pedestals usually could not be built when the backwall was being built, while the amount of concrete in each was so small and the work so scattered that the concreting could be done in this way more economically than with a power mixer. This machine had a 36-in. drum of about 2½ cu. ft. capacity, 32 ins. long, on each end of which was an internal gear meshing with a pinion driven by a crank handle. The charging and dumping were done through openings extending across the drum, and the concrete was dumped directly into the forms, the machine being carried by a pair of 30-in. wheels so that it was easily shifted from place to place.

Municipal engineers are brought more closely into touch with the struggle in which the empire is taking such a vital part by the precautionary measures that are being taken. Special guards have been posted at Montreal's two reservoirs, as well as at the conduit and pumping plants. Following the example of the Dominion Government in placing a guard on the Welland Canal the city of Toronto is guarding its waterworks system, which is the most vital of its public service. It will no longer be possible to obtain access to any part of the system without a special permit from the department, and extra watchmen will be kept on duty at all hours. Recommendations in favor of placing the Hamilton water-works under guard have also been made.

Leaks in a concrete pressure conduit 1,885 ft. in length and 7 ft. in diameter, which led from the basins to the pumping station at the Bissels Point water intake in St. Louis, were comparatively few, according to the annual report of the water commissioner, despite the fact that work was carried on at temperatures ranging from 70 to 20 deg. Fahr., and that the conduit was exposed during the most severe weather. No temperature cracks were apparent and the comparatively few leaks that did show up were near the top at the end of a day's work and where a dry mix was used. The leaks were easily repaired and the conduit was made watertight before backfilling began. All concrete was of gravel with cement and sand in such proportions that one sack of cement produced 4½ cu. ft. of concrete. Twelve pounds of hydrated lime were added to each sack of cement and the mixture was retained in a batch mixer for 3 minutes.

Bulkheads for tunnel forms are always difficult to build because of the roughness of the rock profile. The Pneumatic Concrete Placing Company, of New York City, which is specializing in tunnel-laying work, has been experimenting to find a suitable way of building such bulkheads quickly and cheaply, and has found that cement sacks three-quarters full of sand can be used successfully. The sacks are laid on top of each other in the same way as bricks in a wall, and can be fitted into all crevices of the rock, following closely the irregularities of the profile. It is stated that one unskilled laborer placing sacks replaces two carpenters building forms. A bulkhead formed in this way is said to be tight, and is left in place the same length of time as a wooden one. When the sacks are removed the concrete surface is rough and gives a good bond with the adjacent section.

In scrubbing concrete surfaces, care must always be taken to avoid roughening or blunting corners of the work, and to maintain all edges sharp.

LETTERS

The Deposit Cheque

London, Eng., August 1, 1914.

Editor Contract Record:

The deposit cheque is such an unfair institution that, to an English reader, the query in the July 15 issue of the "Contract Record" scarcely seems to need a reply. To ask a man to deposit from five to ten per cent. of the amount of his tender, on the off-chance of obtaining work, is really a most barefaced proceeding. "The department does not bind itself to accept the lowest or any tender." It does not even bind itself to enter into a contract with anyone, and if a contract is entered into eventually there is no reliance upon when the procedure will be carried through. If, however, "the persons tendering decline to enter into a contract when called upon to do so"—when called upon to do so, ye gods!—"the deposit will be forfeited."

Put into plain English the matter stands thus: Jones thinks of having some work done. He is not certain whether he will have it done or not, and if he is going to have it done he can't say when. So he calls a score of men around him and he explains the circumstances. "You see I can give no promise at all," he says; "but if you care to weigh out a heavy cheque each and accompany it with the price you think the work could be done for I'll register your name and hold your deposit. I'll accept one of your prices some day and then I'll return all the other deposits, but the deposit of the lucky man I'll stick to, and woe betide him if he gives me cause for complaint. If he does I'll fire him off the job, finish it myself and hold his deposit for ever. Of course, it will be just the same if I never have the work carried out, for until he has carried it out he can't claim the return of his cheque. I? Oh no, I guarantee nothing, absolutely nothing at all. You must think yourself honored to be allowed to have a chance to work for me and to pay handsomely for the privilege."

Now, is that a business proposition? Would any man other than a contractor enter into it, or even be expected to enter into it? Let the engineer try it on himself. Let him prepare plans and specifications for nothing, in competition with a score of others, and let him be forced in addition to deposit a substantial cheque as a guarantee that he will, if and when called upon, supervise the works to the satisfaction of the employer. There is no more reason why the contractor should work for nothing than the engineer, or why the employer should pay the engineer for all he does and the competing contractors nothing, except in the case of the successful man, And to add indignity to injury, when a contractor makes (or at least pleads that he has made) a mistake in the preparation of his tender and asks for the return of his deposit, he lays himself open to suspicion of collusion.

But surely collusion is the last charge that could reasonably be brought in such circumstances. If there had been a ring of contractors, no such error as pleaded could have crept in, and for the ring to have arranged for one of the conspirators to put in a ridiculously low tender and risk the loss of his deposit is beyond the question. If the profit was to be "cut up" among the members of the ring, the tenders would be unreasonably high and not ridiculously low. It cannot be argued logically that to favor the return of the deposit of a man who pleads an error and who has submitted a price at which the work cannot be done is a "vicious principle" or that it "encourages collusion among contractors." A solution to the whole trouble would have been the acceptance of the lowest tender but one.

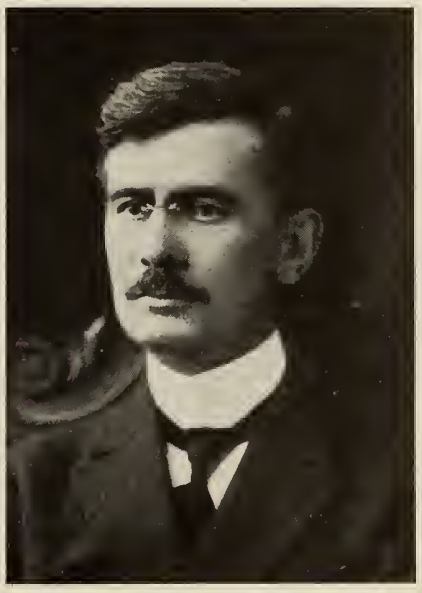
Yours truly,

"An English Reader."

Toronto's New City Architect

Mr. W. W. Pearse, who was recently appointed City Architect of Toronto, is now presiding over the architectural destinies of his native city. Born in Toronto forty-two years ago, he received the rudiments of his education at the public school, passing subsequently to the Jarvis Street Collegiate. He took a five-year course in connection with the Ontario Association of Architects, on the completion of which, at the age of twenty-two, he went to New York. He obtained the degree of Bachelor of Science, after a five-year course at Cooper Union, and also the post-graduate degree of Civil Engineer. Continuing his studies, he took a special three-year course in German methods of engineering. He was elected an Associate Member of the American Society of Civil Engineers, and also a Member of the American Association of Architects. Mr. Pearse is not identified with any other societies.

The practical experience which Mr. Pearse has had in the architectural and engineering fields is very wide, embracing some of the best work carried out in the United States within recent years. While resident in New York he spent all his time studying the engineering side of architecture. Amongst the more important buildings the structural work of which was carried out under his supervision, mention may be made of the armoury for the 71st Regiment, which consists of trusses of 190-ft. span; an armoury for the 2nd Battery, with trusses of 160 ft. span; the Traders and Importers Building of eighteen storeys; five theatres, of which two of the largest are the Broadway Theatre, Brooklyn, N.Y., and the Harlem Auditorium, New York. During his career in the United States he has been the engineer for some of the most prominent architects of New York, including Messrs. Rouse & Goldstone, Messrs. Foster & Gady, Mr. Wm. B. Tubby, Mr. Elliott Lynch, and Messrs. Summerfelt & Steckler. In connection with the last-named firm of architects Mr. Pearse has carried on the engineering work associated with a number of the twelve, sixteen and twenty-storey buildings erected by them in New York.



City Architect Pearse, of Toronto.

Mr. Pearse has been a valued contributor to prominent engineering journals. One article from his pen deals with the complex problem of lattice bars and columns, and another with the buckling of webs and beams.

The Municipal Convention at Sherbrooke

OWING to the European situation and the desire of the Delegates to return home, the Convention of the Union of Canadian Municipalities at Sherbrooke, P.Q., was curtailed. The Convention was to have been held from August 5-7, but on the 6th the delegates decided to close the proceedings.

The opening day was occupied largely with an opening address by Sir Francis Langelier, Lieutenant-Governor of Quebec, in which he deprecated the mixing of politics with municipal affairs. Business men, he suggested, should take a more active interest in local matters. Mayor Mackinnon followed with a speech of welcome, and Mayor Bligh, of Halifax, gave the presidential address. Mr. W. D. Lighthall, K.C., reviewed the activities of the Union during the year.

A resolution was passed asking the Federal Government to give financial assistance in constructing a trunk road across the continent, thus connecting the east and west.

It was proposed by Alderman L. A. Lapointe, Montreal, and Mayor Graham, London, seconded by Controller T. L. Church, Toronto, and Alderman Leslie Boyd, K.C., Montreal: That this convention of the Union of Canadian Municipalities, now being held in the city of Sherbrooke, as representing municipalities throughout the Dominion in entire sympathy with the Mother Country in the position she has taken in this critical moment, places itself on record that any steps taken by our Government to help in protecting the integrity of our Empire will have the fullest support of the united people of Canada." This was carried by a standing vote.

Mr. F. W. W. Doane, City Engineer of Halifax, read a paper on "New Municipal Engineering Matters," while the following other papers were taken as read: "Highway Progress in Quebec," Mayor Hayes, of Richmond, Que.; "Western Municipal Progress," Mr. J. N. Bayne, of Regina, Sask., Deputy Minister of Municipal Affairs, Saskatchewan; "The City Manager," Mayor Graham, of London, Ont.; "Problems of Prevention in a Modern Municipality," Mayor Hocken, of Toronto, Ont.; "Municipal Taxation,", Mr. P. W. McLagan, Chairman of Finance, Westmount, Que.; "Assessment and Taxation," Mayor Oliver, of Port Arthur, Ont.; "Taxation of Improvements," Mr. A. B. McNeill, Alderman of Victoria, B.C.; "Hydro-Electric Power," Mr. B. A. Dugal, Accountant, Electric Dept., Sherbrooke, Que.; "Taxation and Finance in Rural Municipalities," Mr. John Perrie, of Edmonton, Deputy Minister of Municipal Affairs, Alberta; "Housing of the Foreign Population," Mayor Young, of Fort William, Ont.

It was decided to hold the next Convention in Victoria, B.C.

The following resolution was adopted on the motion of Mr. W. D. Lightall: "That in view of the present war situation, although the situation of Canada is most favorable, the municipalities of Canada are recommended to exercise great care and prudence in their undertakings and financing, and especially to consult closely with the local bank authorities on the various aspects of the situation, and to co-operate with them and the Dominion and Provincial Governments for the best course of action.

The election of officers resulted as follows: President, C. M. R. Graham, Mayor of London; 1st vice-president, Controller T. L. Church, Toronto; 2nd vice-president, Ald. L. H. Boyd, Montreal; 3rd vice-president, Ald. Costello, M.D., Calgary; honorary secretary-treasurer, W. D. Lightall, K.C., ex-Mayor of Westmount; assistant secretary, G. S. Wilson, Montreal.

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

Rumors to the effect that the Works Department of Toronto is curtailing its constructional programme are without foundation. All the city's jobs are proceeding as scheduled.

The name of Mr. F. C. Askwith, Assistant City Engineer of Ottawa, has been suggested in connection with the vacancy caused by the retirement of the City Engineer, Mr. Currie.

Messrs. Quinlan & Robertson, Limited, Montreal, have obtained a contract running into $185,000 for paving work on Church Avenue, Wellington Street and LaSalle Road, Montreal.

Mr. John B. McRae, consulting engineer, of Ottawa, will be engaged to co-operate with Mr. R. L. Haycock, Acting Waterworks Engineer, in preparing estimates of the cost of a number of changes suggested in regard to the report on the city's water supply.

The resignation of Mr. Archibald Currie, City Engineer of Ottawa, has been followed by that of the Water-Works Engineer, Mr. A. N. Beer. In the case of Mr. Currie the Board of Control has recommended that he be given three months' salary. Mr. Beer will probably receive two months' salary.

Messrs. Hering & Fuller, of New York, report that ninety-five per cent. of the length of the Montreal water conduit is in satisfactory condition and that the remainder can be repaired readily. The inspection of the thirty thousand feet of conduit was made by Dr. Hering in company with Chief Engineer Janin and others.

Representatives of a prominent American firm of gas and gasoline engine manufacturers were recent visitors to Fort William looking over the situation with a view to establishing a factory. A member of the party stated that it was quite probable that a distributing house would be constructed prior to the erection of a factory.

At Victoria, B.C., a number of the members of the Canadian Society of Civil Engineers met last week at the office of Mr. A. W. Wilby, District Engineer, Department of Marine & Fisheries, and unanimously decided to offer their services to the authorities. A telegram was despatched forthwith to the Minister of Militia. Major Hodgins presided.

Over one thousand residences of moderate size are being constructed in the district within the city of Toronto and east of the Don, and over five thousand men are employed. For the most part they are being constructed for individual owners of lots in the midst of large areas of unoccupied land extending on either side of Gerrard street and north of the Danforth district.

According to a Quebec despatch, H. S. Mundheim, General Manager for the Cement Produce Company of Canada, with factories on the Island of Orleans, on which is established the naval station for the inspection of ships, is held at the citadel as a prisoner of war. Rumors to the effect that he was held as a spy are current, but no authoritative statement is available from the authorities.

The Fort William plant of the Canada Iron Corporation is working to capacity. Orders have been coming in so rapidly of late that it has been necessary to transfer a portion of the work that should be done in Fort William to some of the Eastern plants. This augurs well for the future. The local demand for cast iron pipe, together with orders received from Western Canada cities, has had the effect of keeping the plant running steadily since the first of the year.

Messrs. M. C. J. Bellingham, W. A. Newton and W. D. Cook have formed a partnership under the name of Bellingham, Newton & Cook, engineers and architects, with offices at 213-14 Confederation Life Building, Toronto. These gentlemen have all been on the staff of Mr. D. J. Albertson, of Kalamazoo, Mich., engineering specialist on pulp and paper mills. For the last two years Mr. Newton has been in charge of Mr. Albertson's Toronto office, which was closed recently.

The inquest on the death of Robert Strathern, the Toronto engineer who was asphyxiated while measuring in a sewer, was brought to a close last week. The jury decided that death was due to poisoning by illuminating gas, and were of the opinion that the city of Toronto showed neglect by not instructing all contractors to properly support all underground pipes from the bottom up in such excavations, and also for not engaging qualified resident engineers for sewer work.

At Hamilton last month, the value of building permits taken out amounted to $248,000, while in July, 1913, the amount was but $233,000, the increase this year being $51,900. From all accounts the prospects are exceptionally bright for August, and until the end of the year there should be a good rush. The inspector has been approached by a number of people who intend building this month, which will mean that many permits will be issued and that a good deal of work will be provided for the building trades.

From Fort William comes word that the extension to the sea-wall at the mouth of the Mission river has been completed so far as it is intended to be done this year. The extension to the concrete docks of the Grand Trunk Pacific Elevator is being pushed forward rapidly and will be completed shortly. Good progress is being made by the clam shell dredges at work on the big turning basin now in course of construction about five and one-half miles up the Kaministiquia river. Dredging operations this year have been carried on almost without interruption. The value of harbor improvements this year will total nearly $2,000,000.

The Maritime Dredging and Construction Company, St. John, N.B., have been awarded a contract for additional improvements at St. John harbor. They will build temporary sheds 505 feet in length, 80 ft. in breadth, and 15 ft. high. These sheds will be large enough to handle any additional traffic which is likely to come to St. John next winter. The contract calls for their completion by December 15 next. The Maritime Dredging Company is making good progress with the concrete superstructure on the Connelly wharf, and D. C. Clarke, who is doing the crib work, has nearly completed his contract. In the work of filling in the quay walls the Maritime Dredging Company are laying about 250 yds. of concrete a day.

The city of Hamilton, Ont., will expend $200,000 for concrete sewers and other improvements. The sewers will vary in size from 6 ft. 8 ins. to 30 ins. The larger will probably be laid in tunnel section about 2,000 ft. in length and 24 ft. below the ground surface. The remainder of the sewers will be laid in open trenches. The original plan for sewerage improvements called for an expenditure of $400,000, part of which was to be for the sewage disposal plant. The latter part of the undertaking, however, was abandoned for the time being. It will, however, have to be dealt with within a comparatively short time. It was proposed to reconstruct the present septic tanks in the disposal plant into Imhoff tanks and also to add four more Imhoff tanks to take care of the future flow. The plans were drawn to carry the wells of the old septic tanks down to a depth of 20 ft. so as to allow the concrete aprons to give sufficient sludge capacity beneath. The $200,000 appropriation will furnish funds for a new pumping station with pumps and motors, each pump having a capacity of 7,500,000 imp. gals. per 24 hours. The sewage will be carried through the largest sewer mentioned above to the wells, where the invert of the sewer will be 13 ft. below the level of the water of the lake. From this well the sewage will be pumped to the 30-in. cast iron main to the old disposal works which at present are being used as sedimentation tanks. Mr. A. F. Macallum is City Engineer of Hamilton.

WESTERN CANADA

The Calgary University contract has been awarded to Messrs. Archibald & Company, Winnipeg. The estimated cost of the building is $100,000.

Plans have been approved for the construction of a Roman Catholic Church on the south side of Broadway, Winnipeg, at an approximate cost of $500,000.

A sewage and water system is to be constructed at St. James, by the Rural Municipality of Assiniboia, B.C. The Municipal Engineer has charge of the work, which is estimated to cost about $500,000.

The new gaol and courthouse, which is being erected at Regina at a cost of $100,000, is nearing completion. The general contractors are the Parsons Construction & Engineering Company, Limited.

Plans for a bridge at Banff, Alta., estimated to cost $200,000, have been approved by the Department of Public Works. Operations will be commenced this fall. The bridge will be of concrete construction.

The construction of 85 miles of concrete aqueduct in five sections of approximately equal length, has been decided upon by the Commissioners of Greater Winnipeg Water District. Tenders have been called for September 19.

Plans have been prepared by Mr. Thomas Hooper, Vancouver, for the construction of a reinforced concrete wharf. subway and factory building for the Royal Crown Soaps, Limited, of Vancouver, to be erected on Burrard Inlet.

Plans are in hand for the construction of a $700,000 hotel on Main street and James avenue. The building will be ten storeys, of steel, brick and terra cotta construction. The H. L. Stevens Company, Ill., are the architects and general contractors.

The Trades and Labor Council, Calgary, are protesting against the award of the local university building contract to a Winnipeg firm. The local press states that labor men in the city are generally indignant at the action of the council in bringing in an outside firm.

Work is proceeding on the construction of the new drill hall which is being erected in the northwestern section of Winnipeg at a cost of $110,000. The building will be of brick and stone construction, with steel framework. The Brown Construction Company, Limited, are the contractors.

Work on the hydro-electric plant for the city of Kamloops, B.C., under way for a couple of years past, is now nearing completion. Messrs. DuCane, Dutcher & Company, engineers, Vancouver, announce that the turbines, generators and other equipment will be installed in the near future.

The Canadian Northern Railway has just placed an order with Canadian firms for more than $1,500,000 worth of equipment, sufficient to put on the most modern service between Toronto and Winnipeg, by way of their new line from Port Arthur to Sudbury. It is probable that through trains will run from Edmonton to Toronto as soon as this equipment is delivered. The successful tenderers are the Canadian Car & Foundry Company, the Hamilton National Steel Car Company, the Crossen Car Company and the Preston Car & Coach Company.

Operations have commenced on the erection of an apartment block at the corner of Sargent and Beverley Streets, Winnipeg, which is to be erected by Messrs. Genser Brothers. The building will be three storeys high, of steel and pressed brick construction. The estimated cost is $150,000.

Messrs. Hodgson, King & McPhalen Bros., have been awarded the construction of the proposed extension to the China Creek sewers. The work comprises the following: 2,600 ft. of 6 ft. 6 in. tunnel sewers; 800 ft. of 4 ft. 3 in. tunnel sewers; 21,000 ft. of concrete sewers in trench and 1,500 ft. of vitrified pipe sewer in trench. The contract price was $309,053.

The enterprising city of Vernon, B.C., is about to expend $100,000 on a modern sewerage system. A new disposal plant will prevent the contamination of Kalamalka Creek and Okanagan Lake, and an under-drainage system will be installed to carry off surface water, which now runs into the pipes of the present system and makes the flow excessive.

Mr. C. H. Rust, City Engineer of Victoria, was in Vancouver recently conferring with Mr. G. R. G. Conway, Chief Engineer of the British Columbia Electric Railway Company, respecting the Johnson Street bridge at Victoria. The railway company wish to have the plans of the structure altered to meet the requirements of their heavy electric locomotives. The additional cost will not exceed $50,000.

At Edmonton, Alta., the excavation for the new Central Police station, which is to be erected at a cost of $325,000, has been completed. It is not likely that the erection of the building will be undertaken this season. The structure is planned to be four storeys high, 190 by 60 ft. in dimensions, of stone construction. The architect is Mr. A. Jeffers, and the general contractors are the City Construction Department.

Work is in progress on the G. T. P. Railway hotel to be erected at Regina, Sask., at a cost of $1,000,000. The steel will be supplied by the Canadian Bridge Company, Limited, Walkerville, Ont., and the terra cotta by the Atlantic Terra Cotta Company, Limited, New York. The building will be nine storeys, 160 x 160 ft., steel and stone construction. Messrs. Lyall, Mitchell & Company, Regina, are the general contractors.

A new Association of Architects of Manitoba was formed recently, and a council of nine members was appointed for one, two and three year periods. Mr. H. E. Mitchell was elected president, Colonel Mitchell, vice-president, and Mr. R. G. Hanford, secretary. The old association has been incorporated with the Manitoba Board of Examiners of Architects under an act passed by the provincial legislature last session.

It is encouraging to note that Messrs. Tramways, Limited, the firm which proposes to build the inter-urban line in the Edmonton district, is prepared to proceed with the project as soon as arrangements can be finally completed by the City Council. It was feared that the money for the undertaking would not be forthcoming, but this idea has been dispelled by definite assurance from New York City. It is expected that the firm will employ about three hundred men and eighty teams at the outset.

While the $300,000 mark was not reached at Regina last month, the building permits for July make a good showing when compared with the corresponding month last year. The total for the month was $258,780, as compared with $215,925 for July last year. The principal feature of the July permits was the large proportion issued for the construction of residences, nearly all the permits being in respect of private houses.

At Calgary, the Waterworks Engineer, Mr. A. W. Ellson Fawkes, has submitted to the Commissioners a detailed statement concerning the proposed gravity water supply from Elbow River. The total estimated cost of the undertaking is $2,000,000. The largest contributing items of expense are the construction of a masonry dam at a cost of $537,000; 32 miles of 36-in. wood stave pipe at a cost of $680,000, and earth-work at a cost of $554,000. The Commissioners have decided not to submit a by-law to the ratepayers this year, although they have practically adopted the scheme.

On the north shore of Burrard Inlet, opposite Port Moody, the Imperial Oil Company is erecting an immense plant upon which over 350 men are employed. The buildings comprise a brick power house, machine shops, storage sheds, etc., and the plans provide for thirty-five large tanks for the storage of oil. Two of these reservoirs will be 115 feet in diameter, and 35 feet in height; three will be 93 feet in diameter, and the same height; six will be 50 feet in diameter, and the rest will be of smaller dimensions. Kerosene, naptha, lubricating oil and gasoline will be refined or distilled, as the case may be. In order to accommodate the tank steamers which will bring oil from California, the company will build a dock 750 feet long, out to deep water, with slips for smaller craft. Powerful pumps will transfer the oil from the vessels to the tanks and storage reservoirs.

The Provincial Government of British Columbia is erecting two new pumping stations on the dyked lands adjoining the Pitt River. One of these stations is to be located on the Maple Ridge side and the other on the lower Coquitlam side of the river. These new plants have been necessitated by the growing utilization of these dyke lands. In the last two years a number of industries have been located on the Coquitlam side, and these required considerable land drainage pumping during the summer freshet season. The water in the ditches inside the dykes will now be maintained at a much lower level than heretofore. This will be accomplished by the large centrifugal pumps which are onw being installed. These pumps have been ordered by the government from the W. Poole Dryer Company, Limited, Engineers, of Vancouver and Glasgow, Scotland. This firm has in the last two years constructed a number of electric pumping plants on the Fraser and Pitt rivers. For the present work they are being manufactured in England. The amount of water pumped by each of these sets would be 30,000 gallons per minute, this quantity requiring a discharge pipe of 36 inches diameter. The pumps, which are to be belt-driven by electric motors, were selected by the engineers largely on account of their high efficiency.

"The Hy-tex House of Moderate Cost," published by the Hydraulic-Press Brick Company, St. Louis, Mo., is an attractive book which contains a selection of nearly one hundred designs submitted in connection with a competition conducted last spring by the Brickbuilder at the instance of the above firm. The plans were prepared by architects who were given a definite problem of a detached house faced with Hy-tex brick to be built at a cost not exceeding $7,000. It was assumed that the house was to be located in a town, small city, or suburb of a large city, on a level lot of any size or shape. Nearly four hundred designs were submitted by prominent architects throughout the country, so that no special commendation of the drawings reproduced in the book is required. Suffice it to say that the various sketches offer many interesting ideas and that the book should be well received by architects and prospective builders.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Amherstburg, Ont.
The paving of Richmond street at an estimated cost of $8,667, is being considered by the town council. The town clerk is Mr. Gordon E. Pulford.

Brantford, Ont.
Tenders will be received by Fred W. Frank, City Hall, until 1 p.m., August 29th, for furnishing the materials for and the construction of a new pump well.

The Brampton Estates, Ltd., of Queen St., are inviting tenders for grading and turn-piking and opening up of the streets of "Highland Park property."

Collingwood, Ont.
The question of the expenditure of the sume of $21,104 on improvements to the waterworks system is under consideration by the Water and Light Commission, the town council, and the Board of Health.

Ford City, Ont.
A by-law has been prepared authorizing the construction of water mains on Maisonville, Drouillard Rd., Ottawa, Charlotte and Elrose streets.

Galt, Ont.
The town council has under consideration the construction of house and storm sewers on McNaughton, Henry and Albert streets.

A by-law authorizing the expenditure of approximately $20,000 on road improvements and the purchase of road machinery was carried by the ratepayers on August 10th.

Guelph, Ont.
The work of constructing the Waterloo avenue storm drain, together with the laying of macadam pavement and street car tracks, is being undertaken by day labor under the supervision of the engineer, Mr. E. J. Holland.

Montmagny, Que.
Tenders will be received by the Sec.-treas. of the municipal council until September 2nd for the construction of drains. Plans and specifications at the office of Messrs. Gauvin & Beauchemin, Engineers, Quebec Railway Building, Quebec.

Niagara Falls, Ont.
The city council is considering the construction of macadam roadway by day labor. The engineer is Mr. F. J. Anderson.

Oakville, Ont.
The town council proposes to construct concrete cement pavement 50 ft. wide with concrete cement curb on Colborne street. The estimated cost is $18,720.

Ottawa, Ont.
The city council is about to purchase an auxiliary electric pump which will be installed at the pumping station.

Tenders are about to be called by the city council for the construction of pavement on Cumberland street, at an estimated cost of $22,437.

The city council is about to call for tenders for the construction of asphalt pavement on Cumberland street, between St. Patrick and Rideau streets.

Plans have been drawn for the construction of pavement on York street, at an estimated cost of $11,000. The approximate quantities are asphalt, 3,150 sq. yds.; gutter, 1,848 lin. ft.; headers, 94 lin. ft. Tenders will be called shortly.

It is also proposed to lay asphalt pavement on Bell street at an estimated cost of $14,200, in addition to which tenders will be called for the construction of asphalt pavement on various streets, involving a cost of approximately $45,000.

Peel County, Ont.
The county council is considering the repairing of the Cooksville road for 4½ miles, at a cost of $1,000 per mile.

Point Grey, B.C.
The construction of a 6-in. watermain on Carnarvon street, 24th avenue and Yew street, has been authorized by the municipal council.

Renfrew, Ont.
The question of the construction of a storage dam at Clear Lake has been referred to the waterworks committee to report on.

Richmond, B.C.
The by-law authorizing the expenditure of the sum of $40,000 on extensions to the waterworks has been passed by the municipal council.

Sandwich, Ont.
A by-law providing for certain extensions to the watermains has been passed by the town council.

St. Thomas, Ont.
The water and light commission has received from the city council a recommendation for the extension of the watermains from Dundas street into the new fair grounds.

Toronto, Ont. (Newmarket)
The road and bridge committee has decided to construct new walks on Prospect and Millard Aves.

Thorold, Ont.
The construction of a sewer on Elgin street is being considered by the town council.

Usborne Twp., Ont.
The engineer, Mr. J. Rogers, has been instructed to report on the needed improvements to the Brock Creek drain and branches.

Vancouver, B.C.
The Board of Works has approved of the construction of new sewers in 11 streets in No. 8 ward.

Vernon, B.C.
The city engineer has submitted estimates for the construction of sewer extensions on Pine St., $1,059; Langrill St., $865; Gore St., $311; Barnard Ave., $506. Extensions to watermains totalling between 800 and 900 ft. will also be made.

West Flamboro Twp., Ont.
The township council proposes to construct a sidewalk on Bullock's Corners. Mr. Ira N. Binkley, of Greensville, is the township clerk.

Winnipeg, Man., Transcona
Tenders will be received by the secretary to the Transcontinental Railway, Ottawa, until noon Aug. 25th, for supplying and laying complete with valves, elbows, special castings, etc., 12-in. cast iron pipe from the pump house at St. Vital to the reservoir at Transcona, approximately 31,100 ft. Plans and specifications are at the office of Chief Engineer, Ottawa, and the Acting District Engineer at St. Boniface, Man.

CONTRACTS AWARDED

Cranbrook, B.C.
The city council has awarded to Messrs. Hotson, Leader & Goode, of Lethbridge, the contract for the construction of the dam, digging the necessary ditches and laying the pipe line in connection with water system.

Contrecoeur, Que.
The municipal council has awarded to Mr. Albert Thibaudeau the contract for the construction of macadam roadway and drainage, at $9,900 and $3,541 respectively.

Edmonton, Alta.
The municipal council has awarded to the Robertson-Godson Co., Ltd., of 572 Beatty, Vancouver, the contract for 10,000 ft. 4-in. steel main pipe.

The contract for the construction of the sewage disposal plant at Ross Flats has been awarded by the city council to the Midland Construction Co., 13th and Columbia avenue.

Montreal, Que.
The Board of City Commissioners has awarded to Messrs. Quinlan & Robertson, Ltd., of 1680 St. Patrick St., a contract for the construction of pavements on Church Ave., Wellington St. and LaSalle road.

Messrs. Laurin & Leitch, of 5 Beaver Hall Sq., have been successful in obtaining the contract for the construction of the Park avenue subway.

Morris, Man.
The municipality of Morris has awarded to Messrs. Sheuman & Simpson, of

Winnipeg, the contract for grading and building Pembina Highway from Union Point to this town, at 14¾ cents per cubic yard.

New Toronto, Ont.
The town council has awarded the following contracts in connection with the construction of the waterworks plant. Filters, Roberts Filter Mfg. Co., Philadelphia, Pa., $10,000; pumps and motors, Canadian Allis-Chalmers, Ltd., 212 King St. W., Toronto, $4,000.

Point Grey, B.C.
Messrs. Robt. McLean & Co., of 744 Hastings St. W., Vancouver, have secured the contract for the laying of the sewers on 33rd avenue.

St. John, N.B.
The following contracts have been awarded in connection with the extensions to the watermains. Messrs. French, Moses & Simon, Marsh Road, $158. Rock $3.25 per lin. ft.; earth 79c per lin. ft. Mr. Fred Nice, of 20 King St. W., Sand Cove Road, $2,450. Rock $3.50 per lin. ft.; earth 50c per lin. ft.

Toronto, Ont.
The Board of Control has awarded to the Turbine Equipment Co., Trenton, N. J., and Peterkin Bldg., Toronto, the contract for the supply of the following pumps in connection with the waterworks: first unit, $50,400; second unit $48,400.

Winnipeg, Man., Fort Garry
The municipality of Fort Garry has awarded to R. Mareoux, of 64 Provencher Ave., St. Boniface, the contract for laying 1½ miles of concrete paving on Pembina Highway.

Railroads, Bridges and Wharves

Athalmer, B.C.
The Railway Board of Commissioners has approved the location of the C.P.R. station at this point.

Aubrey, Que.
The plans and location for the new Grand Trunk Railway station here have been approved by the Railway Board.

Ayr, Ont.
The Waterloo county authorities are considering the construction of a bridge over River Nith, at an estimated cost of $5,000.

Brantford, Ont.
Plans have been prepared by the Lake Erie & Northern Rly. Co., for the erection of stations on the line of railway from Brantford to Port Dover. Mr. H. P. Kellett is the engineer.

Belleville, Ont.
The Dominion Construction Company has made surveys for the construction of a new line on the C. P. R. to Bethany Junction. The work will be started within a month. The company may also get the contract for the road from Shannonville to Kingston.

Coquitlam, B.C.
The site of the C. P. R. station east of Kingsway road has been approved by the Railway Board.

Eastend, Sask.
The location of the Canadian Pacific Railway station has been approved by the Railway Board at mileage 253, Weyburn Stirling Branch Line.

Owen Sound, Ont.
Plans have been drawn for the construction of a dry dock and shipbuilding plant by Mr. E. D. Pitt, Victoria avenue, Niagara Falls, Ont. Major Gillette, of Philadelphia, is the consulting engineer. The estimated cost of the project is $1,500,000.

Sandwich, Ont.
The by-law calling for the expenditure of $10,000 on the construction of a public dock has been defeated by the ratepayers.

Scarboro Twp., Ont.
The construction of a steel and concrete bridge over the Rouge River is being considered by the township council. The work, if decided upon, will probably not be started this year.

St. John, N.B.
It is proposed to repair the freight shed and the depot of the Intercolonial Railway recently damaged by fire. Nothing has been decided about the rebuilding of the grain elevator.

Vancouver, B.C.
The Macdonald Marpole Company has filed plans at the office of Public Works, Ottawa, and with the District Registrar of Land Titles, Vancouver, for extensions to their wharf at False Creek.

Windsor, Ont.
Tenders will be received by the Department of Marine and Fisheries, Ottawa, until August 31st, for the construction of a lighthouse tower on the Livingstone Channel in the Detroit River. Plans are at the post offices in Amherstburg, Windsor, Chatham, London and Toronto, 48 Adelaide St. E.

CONTRACTS AWARDED

Bruce Mines, Ont.
The Public Works Department has awarded the dredging contract to the Soo Dredging and Construction Company, of Sault Ste. Marie.

Hamilton, Ont.
The contract for the construction of the revetment wall at Burlington has been awarded by the Public Works Department to Mr. D. G. Stewart, Alexandra Hotel, Ottawa, at $90,000.

London, Ont.
The London & Port Stanley Railway Company has awarded to The Pere Marquette R. R. Co., and Messrs. Marble & Palmer, of Detroit, Mich., U.S.A., the contract for regrading and reballasting road bed, removal of old ties, tie plates, and to supply new ties, frogs, switches, etc., where needed. The road is to be electrified.

Margaree, N.S.
The dredging contract has been awarded by the Public Works Department to Mr. V. T. Bartram, of 117 Stair Bldg., Toronto.

Mornington Twp., Ont.
The Perth county authorities have awarded the bridge contract to Messrs. A. Hill & Company, of Mitchell.

New Glasgow, N.S.
The bridge contract has been awarded by the municipal council to Mr. C. A. Mitchell, of Provost street; the contract includes the construction of street railway tracks, sidewalk, sewer and watermains.

Ritchot, Man.
The municipality of Ritchot has awarded to Hill Bros., of 606 McIntyre Bldg., Winnipeg, the contract for the construction of reinforced concrete culverts in Pembina, St. Marys and Willard roads.

St. Catharines, Ont.
The Dom. Govt. Dept. Railways and Canals has awarded to Mr. A. T. Bradley, of St. Catharines, and Mr. David Walker, of Toronto, the contract for the construction of the stone protection on Summit Level between Thorold and Port Colborne, Welland Canal.

St. John, N.B.
The Pubilc Works Department has let to the Maritime Dredging Co., of King St., the contract for the erection of the temporary freight shed for the new wharf now being built. The work is to start about the middle of September and is to be completed November 1st.

Toronto, Ont.
The York Twp. Council has awarded to the Toms Contracting Co., Ltd., of 12 Rusholme Park Cres., the contract for the construction of a concrete truss bridge over Don River, near Schmidt's Hill. Superstructure, $1,745; substructure, $1,189.

Thorah Twp., Ont.
The Portage Road bridge contract has been secured by Mr. Wm. Yule (c/o Jno. McArthur, Beaverton, at $7.50 per cu. yd.

Winnipeg, Man., St. Boniface
The Manitoba Bridge and Iron Works have secured the contract for the construction of the superstructure of the Provencher Avenue bridge, at $253,004.

Public Buildings, Churches, Schools, etc.

Brantford, Ont.
The city council is about to call tenders for the painting of the courthouse.

Chapleau, Ont.
Tenders for the erection of a boarding school will be received by Mr. J. D. McLean, secretary to the Department of Indian Affairs, Ottawa, until noon, Aug. 24th, Plans and specifications are at the Post Offices, North Bay and Sudbury, the offices of A. D. McNabb, Indian Agent, Sault Ste. Marie, W. Russell Brown, Indian Agent, Port Arthur, and Wm. McLeod, Indian Agent, Chapleau, and at the Department, Ottawa. The buildings are to be fully completed by September 1st, 1915.

Fort George, B.C.
Tenders for the erection of a 2-room school building will be received by Mr. J. E. Griffiths, Public Works Department, Victoria, until noon Aug. 25th. Plans, etc., are at the office of Mr. Thos. W. Herne, Govt. Agent, Ft. George, H. G. Perry, Sec. School Board, Ft. George, and at the Dept., Victoria.

London, Ont.
Advance sketch plans have been made for the erection of a church on Maitland street for the Latter Day Saints.

Montreal, Que.
The date for receiving tenders for the

erection of the National Athletic Associations club house has been extended to Sept. 1st. Mr. J. O. Turgeon, 55 St. Francis Xavier street is the architect.

Messrs. Nobbs & Hyde, architects, Old Birks Bldg., have drawn plans for the erection of the "Bancroft" school, on St. Urbain street, near Mount Royal, for the Board of Protestant School Commissioners, 197 Peel street.

Montreal, Que., St. Laurent

Tenders for interior fittings at the post office will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. Aug. 26th. Plans and specifications are at the office of Mr. Jos. Sawyer, architect, 417 Guy St., Montreal. R. L. Deschamps, overseer, Montreal Central Post Office, and at the Dept., Ottawa.

Montreal, Que. (Verdun)

D. J. Spence, 46 Beaver Hall Hill, the architect, will receive tenders for general contract and separate trades in connection with the proposed erection of the Verdun Athletic Club House on Church street.

Morley, Alta.

Tenders will be received by Mr. Duncan C. Scott of the Dept. of Indian Affairs, Ottawa, until Aug. 24th, for construction of an Indian Boarding School, to be completed Sept. 1st, 1915.

Mount Forest, Ont.

The council has passed a by-law granting the School Board the sum of $2,000 for installation of heating and ventilating system in the high school.

Ottawa, Ont.

The mayor has under consideration the erection of a new city hall with court house, jail, etc., combined. A report thereon is expected at an early date.

Peterboro, Ont.

Plans are now about ready, and tenders will be called shortly by the Public Works Department, for the erection of the new post office, custom house, etc., on George and Sherbrooke streets.

Quebec, Que.

The contract for the erection of the presbytery for St. Roch's Parish, St. Joseph street, has been awarded to Mr. Jos. Villeneuve, Richardson St., at $45,000.

Regina, Sask.

A 80-acre site has been secured for the erection of the stock yards and abattoir. Temporary buildings are to be erected at once for this year's business at an estimated cost of $25,000.

Sherbrooke, Que.

The proposal to make certain additions to the Queen Street High School has been postponed for a year on account of the financial situation.

Souris, Man.

The 21st of August is the date fixed upon which the ratepayers will be asked to vote upon the proposal to expend the sum of $8,000 on the erection of a school house in this district.

Stonewall, Man.

A by-law is about to be submitted to the ratepayers, asking for authority to erect a school building at an estimated cost of $12,000.

Sandwich, Ont.

The by-law calling for the expenditure of $10,000 on the erection of a firehall, has been defeated by the ratepayers.

St. John, N.B.

Tenders received for the erection of a school building at the corner of Douglas Ave. and Bently St., have been returned as the project has been postponed owing to the prevailing financial conditions.

Tilbury, Ont.

At a meeting of the town council a committee was appointed to have plans and specifications prepared for a fire hall, to be erected on the site of the present building.

Toronto, Ont.

Tenders for general trades on the erection of the First Church of Christian Science, at the corner of St. George St. and Lowther Ave., will be received by the clerk, Mr. A. E. Blainey, 62 Herbert Ave., until Aug. 21st. Plans and specifications are at MacLean Daily Reports, Ltd., 220 King St. W., Robins, Ltd., 105 Victoria St., and the Sutherland Constr. Co., Ryrie Bldg. The building is to be of Ionic design and stone and brick construction.

Vancouver, B.C.

Permission has been granted to the School Board for certain alterations to "Dawson" school, at a cost of $9,000.

G. P. Bowie, Bank of Hamilton Bldg., E. Wallington, 615 Hastings St. W., and J. J. Donnellan, 319 Pender St. W., are now preparing plans for a hospital building and an apartment house, for Messrs. Hampton & Edgar, 32 Granville street.

Winnipeg, Man.

The work upon the new Knox Presbyterian Church on Qu'Appelle Avenue has been postponed indefinitely.

The project of the Ancient Order of Foresters, involving the expenditure of $75,000, on the erection of a hall and lodge rooms, has been postponed until next spring.

West Point Grey, B.C.

The plans of Messrs. Twizell & Twizell, of 1019 Metropolitan Bldg., Vancouver, have been accepted by the School Board, and tenders will be called as soon as specifications are prepared.

CONTRACTS AWARDED

Chipman, N.B.

The contract for masonry in connection with the erection of the Roman Catholic Church has been let to P. Jennings & Son, of Red Head Rd., St. John, N.B.

Durham, Ont.

The Public Works Department has awarded to Mr. Jacob Hahn, of Mary St., Hanover, the contract for the erection of the public building.

Edmonton, Alta.

Mr. Sydney Gee has secured the contract for the erection of the St. Paul's Anglican Church at the corner of Kinistine and Short streets.

Elmira, Ont.

The sub-contract for carpentry in connection with the erection of the post office on Arthur street has been secured by Mr. Will Brox.

Hamiota, Man.

The following contracts have been awarded in connection with the erection of a 4-room addition to the school building. General contractor, G. Harris, c/o Virden Saw & Planing Mill, Virden, Man.; heating, Winnipeg Steam Heating Co., Main St., Winnipeg.

Montreal, Que., Lachine

Mr. A. Lonegon, the local contractor, was the successful tenderer for the erection of the fire and police station in the Summerlea Ward.

Medicine Hat, Alta.

Mr. M. C. Sackrider, of Main and Railway streets, has been successful in securing the contract for the alterations and additions to the public building.

Midland, Ont.

The following contracts have been awarded in connection with the erection of an 8-room school building for the School Board. General contractor, S. Woolner, Robinson St., Collingwood, $27,150; heating and plumbing, T. J. Campbell, King St., $5,980.29.

Ottawa, Ont.

Messrs. Geo. Eaman & Son, of Isabella St., have been awarded the general contract for the erection of the Sunday School on 1st Avenue for the Glebe Presbyterian Church.

The following contracts have been awarded in connection with the erection of the Sunday School for the First Congregational Church, Kent and Florence streets. Masonry, McArthur Bros., 26 Woodlawn; carpentry, McDiarmid & Tyndall, 652 Gilmour street.

Quebec, Que.

The contract for the post office repairs has been let by the Federal Government to D. Moronda, of 85 Agnes Street.

Sussex, N.B.

The sub-contract for the steel work on the erection of the agricultural college has been secured by the Phoenix Foundry, of St. John, N.B.

St. Sylvestre, Que.

The contract for the erection of the Syndics Church and vestry has been awarded to Messrs. Paquette & Godbout, of 21 William street, St. Hyacinthe.

Toronto, Ont.

The following contracts have been awarded by the Board of Education on the erection of the Domestic Science school in the rear of Winchester street school. Carpentry, Hutchison Woodworking Co., 5 Duke St., $1,278; plastering, W. J. Haddock, 792 Crawford St., $325; roofing, A. Matthews, Ltd., 256 Adelaide W., $131; heating, F. Armstrong Co., 277 Queen W., $1,153; plumbing and drains, F. Armstrong Co., 277 Queen W., $1,110.

The following contracts for miscellaneous school work have been awarded by the Board of Education. Withrow school, plumbing and drain, John Ritchie, 9 Adelaide E., $4,095; Joseph Workman school, plumbing and drain, F. Armstrong Co., 277 Queen W., $165; Bolton avenue school, steam boiler, F. Armstrong Co., 277 Queen W., $1,190; Dewson street school, iron stairs, Canadian Ornamental Iron Co., 88 River St., $682.

(Continued on page 71)

Tenders and For Sale Department

Tenders for Wrecking Building

Sealed proposals addressed to the undersigned will be received up to 10 a.m. **Monday, August 31st, 1914**, for wrecking the building at present occupied by the McCormick Mfg. Company at the corner of Dundas and Wellington Streets, London, Ontario.

The building has a frontage of about 200 feet and a depth of about 165 feet and is partly four storeys and the remainder five storeys. The building is mill construction and contains a large quantity of good hard burned common brick and a good pine lumber, also large quantity of steel.

Wrecking can be commenced immediately. Further particulars can be obtained by writing to the undersigned and every facility will be given for inspecting the building for taking off quantities.

The lowest or any tender not necessarily accepted.

The McCormick Manufacturing Company,
33 London, Ont.

Tenders for the Construction of a Bridge on the Don Section of the Bloor St. Viaduct

Tenders will be received, by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on **Monday, October 5th, 1914**, for constructing across the Don Valley a bridge consisting of five steel arch spans, with piers and approaches; the width being eighty-six feet, and the length, approximately sixteen hundred and eighteen feet. Bidders may obtain specifications, including plans and form of tender, on application to the Commissioner of Works, Toronto, after paying to the Commissioner of Works twenty-five dollars for each set, this sum to be refunded upon return of plans. The Engineer's Estimate of Quantities will also be sent on request. Specifications, including plans, may be seen at the offices of the Commissioner of Works, Toronto; the Commercial Intelligence Department of the Board of Trade, London, England; the Engineering News, New York; Engineering and Contracting, Chicago; and Engineering, London, England.

Those desiring to submit tenders on reinforced concrete construction for the above bridge, are hereby notified that they may prepare and submit, without any expense whatsoever to the City, their own plans and specifications, based on the loading given in the specifications for steel construction, and may tender on the same. These tenders will be received up to noon on Monday, October 5th, 1914.

Envelopes containing tenders must be plainly marked on the outside as to contents.

The usual conditions relating to tendering, as prescribed by City By-laws must be strictly complied with, or tenders may be declared informal.

A deposit in cash, or a marked cheque, equivalent to 2½ per cent. of the amount of the tender, payable to the order of the City Treasurer, must accompany each tender, which deposit will be retained until provisions of by-law 4294 are complied with.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto, July 21st, 1914. 30-33

Greater Winnipeg Water District

Tenders for Aqueduct Construction

Sealed tenders addressed to the undersigned will be received up to noon of **Saturday, 19th September, 1914**, for the construction of Eighty-five miles of concrete aqueduct in five sections of approximately equal length.

Plans, specifications and form of tender can be secured after July 20th, 1914, by application to the District accompanied by certified cheque for One Hundred Dollars payable to the District, which deposit will be returned upon submission of tender or return of documents.

Bidders may tender on any section or on any number of sections.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,
Chairman of Commissioners
901 Boyd Building,
Winnipeg, Man., July 6, 1914. 30-36

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Wiarton, Ont.," will be received until 4 p.m. on **Monday, August 31, 1914**, for the construction of a Public Building at Wiarton, Ont.

Plans, specifications and form of contract can be seen and forms of tender obtained on application to the Postmaster at Wiarton, Ont., at the office of Messrs. Forester & Clark, architects, Owen Sound, Ont., at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, August 6, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—65008. 32-33

Agents Wanted

Large firm making diaphragm pumps with improved patent valves wants to secure agents in Canada. Pumps made in all capacities up to 14,000 gallons per hour. Workable by hand or mechanical power. Address Box 70, Contract Record & Engineering Review, Toronto. 32-37

Tenders for Construction of Sidewalk

Sealed tenders, plainly marked as to contents, will be received by J. G. Cornell, Reeve of Scarboro Township, up to noon of **Saturday, August 22, 1914**, for the construction of a sidewalk on the east side of Blantyre Ave. from Kingston Road to Queen Street, Township of Scarboro.

Plans and specifications and all necessary information may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto, after August 18th. The lowest or any tender not necessarily accepted.

FRANK BARBER,
33 Consulting Engineer.

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday Noon, August 28th,

for the erection of

High School of Commerce and Forest School

also

Cabinet Work, Iron Fences and Terra Cotta Cornices

also

Duke of Connaught School Heating and Plumbing

Specifications and plans may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender, or its equivalent in cash.

Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, not later than twelve o'clock noon on the day named, after which no tender will be received.

The lowest or any tender will not necessarily be accepted.

All tenders must be on the revised forms.

W. C. WILKINSON,
Secretary-Treasurer.
W. W. HODGSON,
33 Acting Chairman of Committee.

Position wanted by reliable waterworks and sewers construction foreman. Good draughtsman; knowledge of transit and level; excellent references. Box 69, Contract Record, Toronto. 31-34

School of Mining and College of Applied Science, Queen's University, Kingston, Ontario. Applications will be received by the undersigned until **September 15th**, for the position of Professor of Civil Engineering, at a salary of $2,500 a year, commencing October 1, 1914. Applicants must be graduates of an engineering school, and preference will be given to men with practical railway engineering experience. The session of the school of mining extends over thirty weeks. Geo. Y. Chown, secretary. 33-34

Municipalities and others sending in tender advertisements for the Contract Record are requested to bear in mind that these must be in our hands by ***Ten o'clock on Tuesday morning,*** each week, in order to be published in the issue of the following day.

JUDICIAL SALE

of the Assets of

The Canadian Mineral Rubber Co.

LIMITED

In the matter of the Winding-Up Act, being Chapter 144 of the Revised Statutes of Canada and Amending Acts, and in the matter of the Canadian Mineral Rubber Company, Limited.

Sealed tenders will be received addressed to "George O. Alcorn, Esq., Master-in-Ordinary, Osgoode Hall, Toronto, Canada," and marked "Tenders in the matter of The Canadian Mineral Rubber Company, Limited," up to 2.30 p.m. of Friday, the 18th day of September, 1914, for the purchase of certain assets of the said Company consisting of:—

PARCEL No. 1—Located at Model City, adjoining Montreal, and at Sorel, Que.

Cummer asphalt paving plant, railroad type, and sundry accessories including rollers, concrete mixers, tank cars, tools, etc., etc.

PARCEL No. 2—Located at Winnipeg, Manitoba.

Roofing and flooring material and equipment, paint, pipe-coating, office furniture, safe, etc., etc.

PARCEL No. 3—Located at Calgary, Alberta.

Merriman asphalt paving plant, railroad type, and sundry accessories, including roller, stone crusher, concrete mixers, hoisting engine, tools, asphalt, cobbles, office furniture, etc., etc., together with a certain lease of dredging rights for sand and gravel, the liabilities under which must be assumed by the purchaser.

PARCEL No. 4—Located at Vancouver, British Columbia.

Cummer asphalt paving plant, railroad type, and sundry accessories, including rollers, stone crusher, concrete mixers, hoisting engine, tools, asphalt, rock, office furniture, motor-cycle, etc., etc.

PARCEL No. 5—Located at New Westminster, British Columbia.

Merriman asphalt paving plant, railroad type, and sundry accessories, tools, etc., etc.

PARCEL No. 6—Located at Victoria, British Columbia.

Merriman asphalt paving plant, railroad type, and sundry accessories, including rollers, concrete mixers, graders, automobiles, tools, supplies, office furniture, etc., etc.

PARCEL No. 7—Located in the State of Utah, U.S.A.

Certain claims and mining rights covering a deposit of practically pure bitumen (gilsonite) and bituminous limestone.

Possession. Immediate possession of parcels Nos. 1, 2, 3, 4, 5, and 7 can be given on completion of sale. Possession of parcel No. 6 cannot be given until certain paving at the City of Victoria, B.C., in which the Liquidator is at present engaged, is completed. If, before the completion of the sale, the purchaser requires possession of any parcel, of which possession can be given by the Liquidator, he may obtain same by giving security for the unmatured payments satisfactory to the Master-in-Ordinary of the Supreme Court of Ontario. Tenders must be made on the understanding that inability on the part of the Liquidator to deliver possession of, or transfer the title to any item shall operate as a cancellation of the sale in respect of such item only, and shall not operate as a cancellation of the sale as a whole. The amount of any allowance to be made in respect of any such item shall be determined by the Master-in-Ordinary of the Supreme Court of Ontario.

Tenders will be received for all parcels en bloc and for each parcel separately.

All rentals, taxes, insurance, water rates, and similar items will be adjusted to the date of the acceptance of the tender.

Full information as to all parcels with inventories of parcels Nos. 1, 2, 3, 4, 5 and 6, and a schedule of the claims and mining rights included in parcel No. 7, and copies of the Lease referred to in Parcel No. 3, may be obtained from the Liquidator,

NATIONAL TRUST COMPANY, LIMITED, TORONTO, CANADA.

Terms of Payment. Ten per cent. of the amount tendered shall accompany each tender, 15 per cent. on the acceptance of the tender, and the remainder in 3 equal instalments at 3, 6 and 9 months without interest. On receipt by the Liquidator of the final payment, the sale shall be completed. All tenders must be accompanied by an accepted cheque payable to the Liquidator for 10 per cent. of the amount of the whole tender, which cheque will be returned if the tender is not accepted, and forfeited if the tender is accepted, and purchase not completed by the tenderer.

The highest or any tender not necessarily accepted.

The purchaser shall, at his own expense, make whatever search of title he may deem necessary or expedient, and the Liquidator shall not be required to furnish any abstracts or produce any deeds, declarations, or other evidence of title except those in its possession. The purchaser shall have 15 days from the date of acceptance of tender within which to make any objections or requisitions in respect of the title and in case the purchaser shall, within such time make any objection or requisition which the Liquidator shall from any cause, be unable or unwilling to remove or answer, then the Liquidator may (notwithstanding any intermediate negotiations) rescind the sale, in which case the purchaser shall be entitled only to a return of the deposit money without interest, costs or compensation.

The other conditions will be the standing conditions of sale of the Supreme Court of Ontario as far as applicable.

Tenders will be opened at the office of the Master-in-Ordinary, Osgoode Hall, Toronto, Can., at 2.30 p.m., on the 18th day of September, 1914, when all tenderers are requested to be present.

Dated at Toronto, this 10th day of July, 1914.

NATIONAL TRUST COMPANY, LIMITED,
Toronto, Ontario, Canada,
Liquidator.

30-31-33-35

FOR SALE—One "Smith" concrete mixer in first class condition. Cost $950. Will sell for $600 cash. Apply Box 72, Contract Record, Board of Trade Building, Montreal 33-36

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, September 1st, 1914**, for the construction of the following sewers, viz.:

Ardagh Ave., Durie Ave. to Runnymede Road.
Cumberland St., Avenue Rd. to Bellair Street.
Ethel Cres., C. L. Rosehill Ave. to west limit Lot No. 1, Plan 920-K.
Glenholme Ave., Rosemount Ave. to St. Clair Avenue.
Glenmanor Drive East, N. S. Pine Cres. to Williamson Road.
Main St., Kingston Rd. to north city limit.
Scollard St., Yonge St. to Hazelton Ave.
Spears Ave., Colbeck St. to Annette Street.
West Toronto Sewer System, Div. No. 2, outlet from 315 ft. north Conduit St. on Woodville Ave. to Birtle Ave. and Indian Road, via lots 98 and 134, Western Ave. and Birtle Ave.
Willard Ave., Bloor St. to Colbeck Street.
Willard Ave., Colbeck St. to Annette Street.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto), or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by city by-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, Aug. 15th, 1914. 33

Business Buildings and Industrial Plants

(Continued from page 69)

Dundas, Ont.

The erection of a warehouse and storehouse on Hatt street, is being considered by Mr. Andrew Motherwell, of Glasgow, Scotland. Plans will be made shortly.

Edmonton, Alta.

The Merchants Bank of Canada proposes to erect a branch on Alberta and Carey streets. Messrs. Barns & Gibbs are the architects.

Esquimalt, B.C.

Mr. Jesse M. Warren, of Central Building, Victoria, is preparing plans for the erection of stores on Esquimalt and Comerford streets, at a cost of $8,000.

Goderich, Ont.

Mr. J. E. Baechler, of North St., contemplates the erection of a third storey to the present building to be used as furniture factory.

Mr. Derrick F. Hamlink proposes leasing 2 lots on Bruce St. from the town on which to extend his factory. If this is built machinery will be required.

Grand Forks, B.C.
Mr. Bernard Leguime is considering the erection of a creamery. The work on the plant will probably be started by the first of December.

Hamilton, Ont.
Messrs. Fryer & Evans, architects, of the Clyde Block, have drawn plans for the erection of stores on James street, for Mr. S. Epstein, at an estimated cost of $18,000.

London, Ont.
It has been decided to do nothing in regard to the proposed alterations to the London Conservatory of Music, until next year, when a new architect will be appointed.

Work on the "Advertiser" printing factory will not likely be started until next year.

Lulu Island, B.C.
The recently incorporated B. C. steel works proposes to erect rolling mills at Bridgeport. Mr. Francis L. Leighton, general manager of the Vancouver Engineering Works, 519 Sixth St. West, Vancouver, is interested in the project.

Mount Hamilton, Ont.
The contract for the erection of Messrs. Reid & Son's plumbing shop has been awarded to Mr. Geo. S. Burkholder.

Tenders on additions to the factory of Mr. J. P. O'Shea, St. Agathe street and Perrault Lane, will be received by the architect, Mr. Chas. Mitchell, 58 Beaver Hall Hill. Estimated cost $40,000. The specifications call for 3 storeys of reinforced concrete construction.

New Westminster, B.C.
The city council has approved the lease of a municipal site to the Brackman-Ker Milling Company whereon to erect a factory to replace the one recently destroyed by fire.

Ottawa, Ont.
The Bronson Company, of Victoria Street, have under consideration the erection of stables, etc., on Middle St.

Summerside, P.E.I.
Tenders on the erection of the branch office of the Canadian Bank of Commerce will be received until August 29, by the architect, Mr. Geo. E. Baker.

Toronto, Ont.
Tenders will be received by the architect, A. J. Rattray, Stair Bldg., for general alterations to stores at the corner of Yonge and Ann streets.

Tilbury, Ont.
The Canadian Top Company proposes to make certain factory additions for which new equipment will be required.

Winnipeg, Man.
Mr. H. E. Magnussen, of 921 Banning street, has under consideration the erection of a new store.

It is understood that nothing will be done this year in regard to the proposed erection of hotel premises on Logan St. by Mr. Larson.

Plans are being drawn by Mr. B. Davison, of 655 Toronto street, for additions to the store of Mr. R. J. Brown, 666 Arlington street. The plans call for 2-storeys, 30 ft. by 50 ft., of pressed brick construction. The estimated cost is $10,000.

The proposal of Mr. J. Maw to erect stores and offices on Donald and Graham streets, has been postponed indefinitely.

Plans are being drawn for the Lombord Investment Agency, 603 Builders' Exchange, for the erection of a 14-storey office building on Lombard and Rorie streets. Mr. P. M. Clemens, 331 Garry street, is the architect.

The Farmers Supply Company has postponed indefinitely its proposal to erect a warehouse on Curtis street.

Mr. A. G. Wills is the engineer and architect in connection with the proposed erection of the Dunlop Pulp and Paper Mills on Main street. It is expected that a commencement will be made this year.

Wellington, B.C.
The Wellington Lumber & Trust Co. proposes erecting a sawmill with a capacity of 200,000 ft. per 24 hours. Surveys are now being made.

CONTRACTS AWARDED

Brantford, Ont.
The Brantford Gas Company has awarded to Schultz Bros. & Co., Ltd., the contract for the erection of its new office building on Colborne street.

Montreal, Que.
It is understood that the erection of Messrs. Henry Morgan & Co.'s factory building will not be proceeded with at present.

Montreal, Que.
Mr. Geo. Martin has been awarded the contract for the erection of 4 stores and 8 flats on Clarke street, for Mr. A. H. Jackson.

Ottawa, Ont.
The contract for the erection of a cold storage house for the Y. W. C. A. Laurier avenue has been awarded to Mr. R. E. McKinstrey, 91 2nd avenue.

Welland, Ont.
The contract for the steel work connected with the alterations to the opera house, has been awarded to the Standard Steel Construction Company. Contracts for the balance of the work will be awarded shortly.

Residences

Edmonton, Alta.
The erection of an apartment block on May street, is being considered by the Western Canada Properties, of 407 Agency Bldg.

Hamilton, Ont., Burlington
Mr. Samuel Greer has under consideration the erection of a residence on Locust street. The architect is not yet appointed.

Montreal, Que.
A permit has been issued to Mr. D. Letourneux, 455 Chambly street, for the erection of flats on Ontario street, at a cost of $5,000.

Plans are being drawn for alterations and additions to a residence on Mansfield street by Mr. D. J. Crighton, Jacobs Building, who invites tenders for general contractor.

Montreal, Que. (Rosemount)
Contracts for the erection of the flats on 43rd Avenue for Messrs. Richardson and Chambers, will not be let until the money market improves. The erection of the residences on 2nd Avenue for the same gentlemen is also postponed for similar reasons.

Montreal, Que., Westmount
Messrs. Audet & Charbonneau, 364 Dorchester St. W., are still open to receive tenders on the erection of the $275,000 apartment house, at the corner of St. Catherine and Glen streets.

Mr. B. W. Griggs, Coristine Bldg., who contemplated the erection of a $30,000 residence on Edgehill road, has decided not to build this year.

Ottawa, Ont.
Mr. W. H. Lee, of Billings Bridge, contemplates the erection of a residence on Hopewell street.

Certain alterations and additions to his residence are being considered by Mr. J. S. Richard, of 296 Cathcart street.

Quebec, Que.
A permit for the erection of a residence on Orago street at a cost of $7,000, has been issued to Mrs. Vve Beule, 320 Orago street.

Regina, Sask.
A permit has been issued to Mr. J. D. Martin, of 2240 Lorne street, for the erection of a $7,000 residence on Angus street.

Sherbrooke, Que.
Mr. H. G. James, architect, of the Whitling Block, has drawn plans for the erection of a residence on Melbourne street for Judge Mulvena. The estimated cost is $6,500.

East Sherbrooke, Que.
The erection of Mr. Wm. Wright's residence on Woodward Ave. has been postponed indefinitely.

Toronto, Ont.
A permit has been issued to Mr. A. McFarren, 56 St. Clair avenue, for the erection of a residence on Lyndhurst avenue, at a cost of $5,000.

Winnipeg, Man.
Mr D. D. Wood is considering the erection of a residence at the corner of Young street and Barrester avenue, at an estimated cost of $5,000.

Messrs. Purcell Bros., of 509 McIntyre Block, and Messrs. E. M. Levins & Co., 413 McIntyre Block, contemplate erecting a number of residences this year.

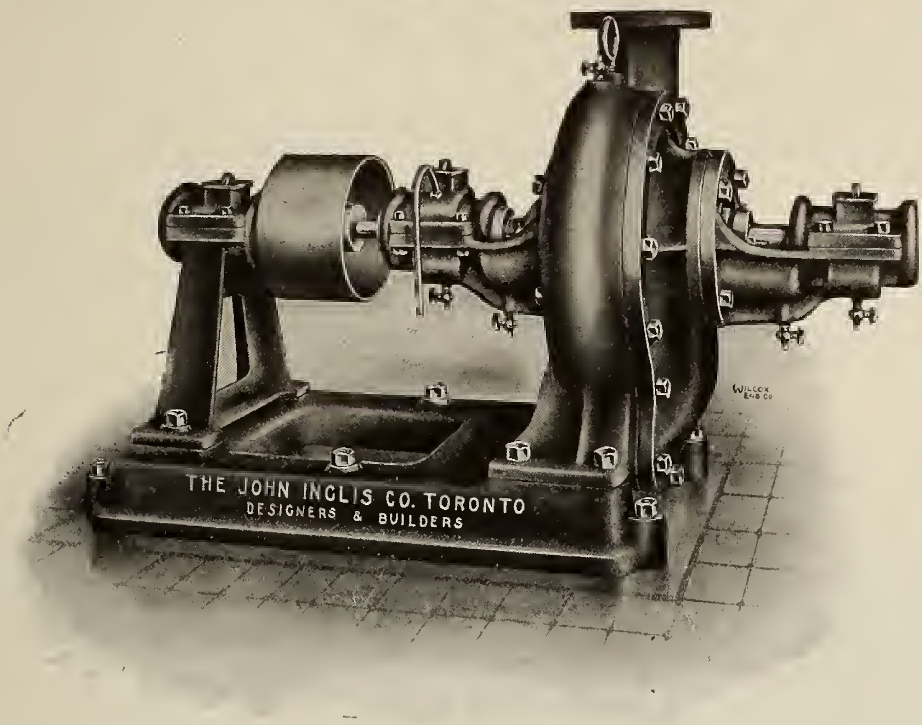
Mr. J. Chisholm, of the Great West Loan Building, has plans in hand for the erection of a residence at Armstrong's Point for Mr. Jabez Miller.

CONTRACTS AWARDED

Hamilton, Ont.
Mr. G. Burkholder, of Mount Hamilton, has secured the contract for the erection of Miss Artman's residence on Main street.

Montreal, Que.
Messrs. Norcross Bros. Co., of New Birks Bldg., have been awarded the contract for the alterations to the residence of Mr. H. V. Meredith, 526 Pine avenue west.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS
14 Strachan Ave., Toronto, Canada
Montreal Office: Room 509 Canadian Express Building

Ottawa, Ont.
Mr. Ed. Wentzliff has been successful in securing the contract for the erection of a residence on Daly street, for Mr. J. D. Dempry.

Mr. R. A. Kemp has been awarded the contract for the erection of Dr. H. C. Church's residence on Powell street.

The contract for masonry on the additions to the Cooper street apartments has been awarded to Mr. J. H. Copeland, of Laurel street.

Toronto, Ont.
The contract for masonry, carpentry and plastering on the erection of Mrs. W. N. West's residence on Castle Frank road, has been secured by the Oshawa Interior Fittings Company, of Delaware avenue.

Vancouver, B.C.
The C. P. R. Co. has awarded to Mr. S. J. Newitt, 954 17 street west, the contract for the erection of the staff residence on Shaughnessy Heights.

Mr. M. Hall, 540 56th avenue, has secured the contract for the erection of a residence on Shaughnessy Heights for Mr. G. V. Fraser.

Power Plants, Electricity and Telephones

Edmonton, Alta.
The city council has refused the offer made by the United Collieries of Canada to supply the city with power for the electric light plant.

Halton & Wentworth Counties, Ont.
The Bell Telephone Co. are constructing a new line between Aldershot and Burlington, a distance of 3½ miles.

Toronto, Ont.
Lines are being surveyed by the Hydro-electric Power Commission for the construction of radial lines from Strathroy to Dresden, via Alvinston; from Wyoming to Chatham, and from Niagara to Port Colborne.

CONTRACTS AWARDED

Brockville, Ont.
The sub-contract for the stone work connected with the erection of the Bell Telephone exchange on Apple street, has been awarded to Mr. Geo. W. Paul, of 156 Victoria street, Sarnia.

Dartmouth, N.S.
The Govt. Dept. Railways & Canals has awarded to Mr. Angus McGillvray, of Antigonish, the contract for the Dartmouth Branch of the Intercolonial Railway telegraph line from Dartmouth to Upper Musquodoboit.

Toronto, Ont.
The following contracts have been awarded in connection with the erection of the civic car barns on Danforth Ave.; general contract, Self Bros., 78 Howard St., $30,740; steel, Can. Allis-Chalmers, Ltd., 212 King St. W., $10,389.15; Kinnear rolling doors, Can. Allis-Cahlmers, Ltd., 212 King St. W., $1,165. The Commissioner will make recommendation shortly in regard to the plumbing and heating.

Miscellaneous

Lauzon, Que.
Tenders will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until 4 p.m. Sept. 2nd, for the renewals of boilers of the Dry Dock at Lauzon. Specifications are at the offices of Dist. Engineers, Quebec, Que., and Shaughnessy Bldg., Montreal, Dockmaster at Levis, Que, and at the Dept., Ottawa. Boilers are to be of the horizontal return tubular boiler type and to be erected in brick setting. Each of the 3 boilers to be 14 ft. 10 in., long overheads x 72 ins. diameter, x 70 4-in. tubes.

Nanaimo, B.C.
Messrs. W. Thomas and A. E. Mainwaring, of the Nanaimo Gas Company, are interested in the proposed construction of a modern plant to manufacture coal gas.

Ottawa, Ont.
The Shepard & Morse Lumber Co.'s driving engine was completely wrecked in an accident. An electric motor will be installed until steam engine can be put in.

Business Notes

Beauharnois, Que.
The Frontenac Hotel on St. Lawrence Street, of which Mr. A. Daigneault is proprietor, was recently destroyed by fire.

Bowen Island, B.C.
The Montrose Hotel at Bindley's Landing, has been destroyed by fire. Loss $10,000.

Cloverdale, B.C.
A recent fire at the plant of the Brick & Tile Co., resulted in a loss of $30,000.

Elk Lake, Ont.
The Temiskaming & Northern Ontario Rly. Co.'s station was destroyed in the recent fire in this district.

Fern Ridge, B.C.
The plant of the Fern Ridge Lumber Company has been totally destroyed by fire. The loss is placed at $150,000, about $100,000 of which was covered by insurance.

Girard, Que.
The general store owned by Mr. Romeo Forget has been burnt out. The property was insured.

Kingston, Ont.
Messrs. Davis & Co.'s tannery was recently destroyed by fire. The loss of $80,000 was covered by insurance.

Knowlton, Que.
The Hon. S. A. Fisher's farm residence was recently destroyed by fire. It is understood that the premises will be rebuilt.

Montreal, Que.
A partnership between Messrs. Arsenault and Plamondon, engineers, has been registered.

Redcliff, Alta.
The drying sheds of the Redcliff Brick & Coal Co. were recently burnt out, and a loss of $5,000 sustained.

St. John, N.B.
The grain elevator and freight shed of the Intercolonial Railway together with 8 cars were recently destroyed by fire.

Toronto, Ont.
The planing mill of H. A. Marshall, 507 Davenport Rd., has been completely destroyed by fire. The loss is placed at $10,000.

New Companies

La Compagnie de Construction de Nicolet, Limitee, has been incorporated with a capital of $20,000, with head office at Nicolet, Que. The provisional directors are H. N. Biron, H. Bourk, N. Jutras, J. H. O. Hebert, of Nicolet, Que., and L. Biron, of Drummondville, Que.

The Fresh Water Sand and Gravel Company, Limited, has been incorporated with a capital of $100,000 with head office at Vancouver, B.C.

The Montcalm Electric Light & Manufacturing Company, Limited, has been incorporated with a capital of $99,000, with head office at Rawdon, Que. The provisional directors are J. T. Gazelle, J. A. Fournier, E. Rowan, W. N. Smiley, and J. Skelly, all of Rawdon, Que.

Reid & Brown Structural Steel and Iron Works, Limited, has been incorporated with a capital of $100,000, with head office at Toronto. The provisional directors are G. Grant, M. Macdonald, G. W. Adams and B. Williams, all of Toronto.

St. Lambert & District Building Company, Limited, has been incorporated with a capital of $500,000, with head office at St. Lambert, Que. The provisional directors are A. Wainwright, K.C., A. Huntingdon, Sr., H. F. Glass and J. H. Wilke, all of Montreal.

Eastern Cities House Building Company, Limited, has been incorporated with a capital of $100,000, with head office at Toronto. The provisional directors are F. C. L. Jones, H. K. Harris and W. F. C. Sellers, all of Toronto.

The Two Paul's, Limited, has been incorporated with a capital of $10,000, with head office at Danville Que., to carry on business as lumber merchants. The provisional directors are F. J. Paul, C. C. Bernard, G. J. Hamilton and W. N. Paul, all of Danville, Que.

Montmorency Land Company has been incorporated with a capital of $40,000, with head office at Quebec. The provisional directors are J. Masse, of St. Appolinaire; J. C. A. Bedard, of Quebec; J. Drapeau, L. Lebrun and T. W. Michaud, of St. Pacome, Que.

The New Glasgow Electric Manufacturing Company, Limited, has been incorporated with a capital of $99,000, with head office at New Glasgow, N.S. The provisional directors are J. T. R. Gazelle and J. A. Fournier, of Montreal; E. Bernard and A. W. & J. MacCubbin, of New Glasgow, N.S.

La Compagnie de Construction de Maisons d'Habitation Salubres Limitee, has been incorporated with a capital of $100,000, with head office at Montreal. The provisional directors are L. A. Rivet, L. G. Glass, J. A. Sullivan, A. Papineau, and R. Gaudry, all of Montreal.

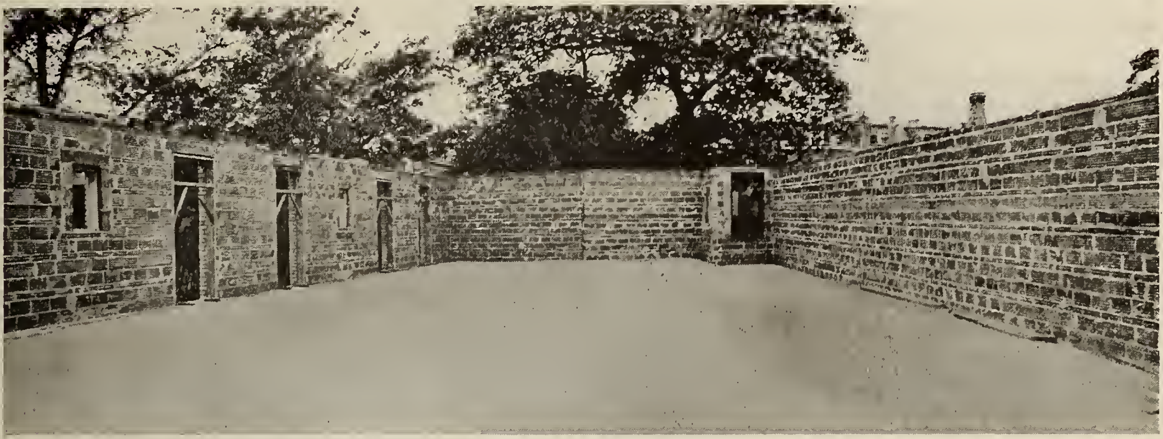
DENISON

Interlocking Hollow Tile

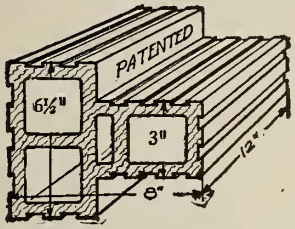
The Modern Building Material

The illustration shows the North West Wing, first storey.
Notice the jamb and corner construction, the lintels and horizontal scoring.
No furring or strapping required.
Denison Interlocking Hollow Tile has been endorsed by architects and contractors.
We should like to tell you more about its particular qualities.

Write or phone us.



Apartment House at 392 Sherbourne Street for Plewes & Storey.
Wm. Fraser, Architect **Chas. Nobes, Masonry Contractor**



It interlocks.

The one shape and size builds all thicknesses of wall.

Write us for full data.

The One Price Company

Sun Brick Company, Limited

Traders Bank Building

One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886

Contract Record and Engineering Review

220 King Street West, Toronto

Record of seven consecutive days work in Chicago of a

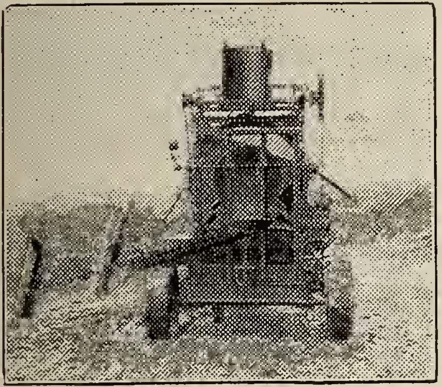
One - Bag Austin Cube Street Mixer

Six-Inch Concrete

Date	Sq. Yd. Daily	Total Sq. Yd.	Date	Sq. Yd. Daily	Total Sq. Yd.
May 13th	1360	1360	May 17th (Sunday)	....	....
14th	1227	2587	18th	1340	6663
15th	1436	4023	19th	1365	8029
16th	1300	5323	20th	1350	9379

Average square yards 1340. Average cubic yards 223½.

This is record of contract work on pavement construction and is signed and sworn to by the inspectors for the city of Chicago.



Features of the Austin Cube Paver

Non-tilting type, material charged at one end and discharged at the other.

Booms, fifteen to twenty-five feet in length, swing at radius of 80 deg. each way.

Machine has ample reserve power.

Built with or without self-traction

All levers within easy reach.

Door at discharge end prevents slopping of concrete.

Bucket or skip drops close to the ground facilitating easy and rapid loading directly into the charging hopper from wheelbarrows.

Machine is set up high enough from the ground so that carts can be backed directly under the discharge spout when it is not desirable to use the boom.

Outfit travels at rate of 1½ miles per hour when equipped with self-traction.

Write to our Canadian Representatives—the one nearest you

LECKY & COLLIS, Limited, Montreal, 49 Beaver Hall Hill, Toronto, 43 Scott St. Napanee, P. O. Box 611

CANADIAN EQUIPMENT & SUPPLY CO., Calgary and Edmonton E. G. CULLEN, 418 Pacific Bldg., Vancouver

Municipal Engineering & Contracting Company

Eastern Office: 30 Church Street, New York City **Main Office: Railway Exchange Bldg., Chicago, U. S. A.**

TANKS

for

Pulp and Paper Mills
Chemical Works
Oil Refineries, Etc.

We also build

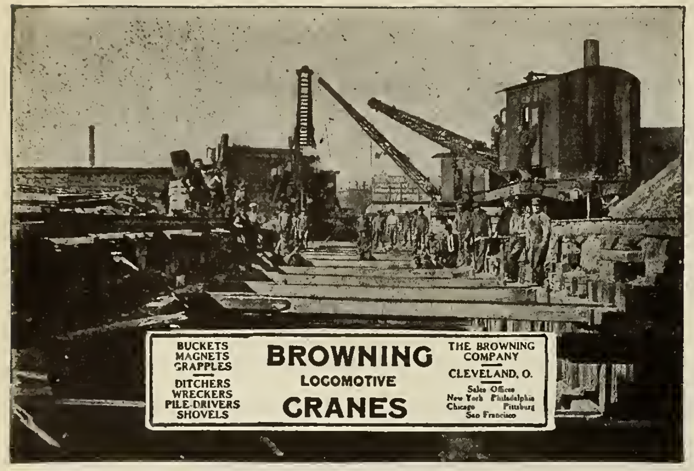
Steel Structures

to support them.

Write us for quotations

MacKinnon, Holmes & Company Limited

SHERBROOKE, QUE.



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CRANES

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Select from the whole field those opportunities that promise the most profit, and which you can handle to the best advantage. Use MacLean Daily Reports. Rates and samples on request.

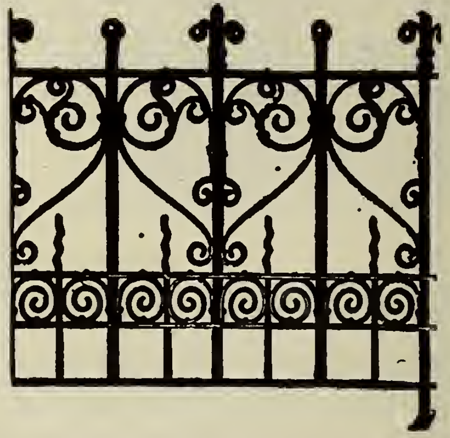
MacLean Daily Reports Limited
220 King St. West, TORONTO, CAN.

"Hammer Brand"
Hard Wall Plaster

HARD-WALL PLASTER
HAMMER
BRAND
HILLSBOROUGH, N.B.

It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

Albert Manufacturing Co.
Hillsborough, New Brunswick, Canada



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Every conceivable style and design in ornamental iron fence work can be faithfully carried out by us.

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We also specialize in iron stair work.

The **GEO. B. MEADOWS**
Toronto Wire Iron and Brass Works Co., Limited
Meadows Block, Wellington St. W.
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Keiths LIMITED

Do YOU intend installing, or have YOU thought of REFRIGERATION as applied to YOUR needs or processes?

Refrigeration--Ice Making
Cold Storage

TORONTO & MONTREAL

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Company,
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If so write us at address as below for information on this subject. We are anxious to talk this matter over with you and to give you the benefit of 35 years' experience of refrigeration.

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Save time, labor and future trouble and **insure highest efficiency** not only for a few months but for **all the time.**

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The Ric-wiL Underground Pipe Covering Company

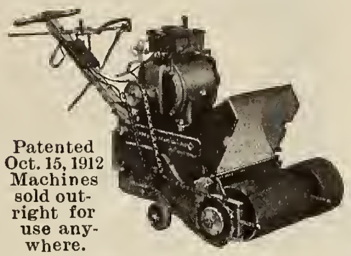
66 New England Bldg., CLEVELAND, O.
Genl. Mfgs. Agencies, Toronto-Montreal

THE AUTOMATIC BALL BEARING ELECTRIC FLOOR SURFACING MACHINE

Contractors and builders find, dresses in paying quantities, quarter-sawed oak, maple, etc., the way they want it or rapidly refinishes old floors. Having ballbearings, roller and dust-suction fans spin true and easy: yielding arms give flexible or rigid roller as needed; self-propelling with automatic control gauges roller cut for even work and brakes forward pull for large capacity—you simply guide. Surfaces to base baseboard with Edge Roller. No hand scraping. Booklet tells all about it and our

FREE TRIAL OFFER

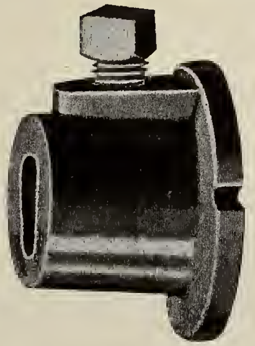
Made in several sizes for small rooms or large areas. Let us send you the names and addresses of Canadian owners near you.



Patented Oct. 15, 1912 Machines sold outright for use anywhere.

Wayvell Chappell & Co.
Dept. F, 4845 Ravenswood Ave.
CHICAGO, ILL.

Universal Form Clamp



Secured to the ends of round rods passed through your forms, these inexpensive clamps hold the centering rigid, resisting a strain exceeding the tensile strength of the steel rods themselves.

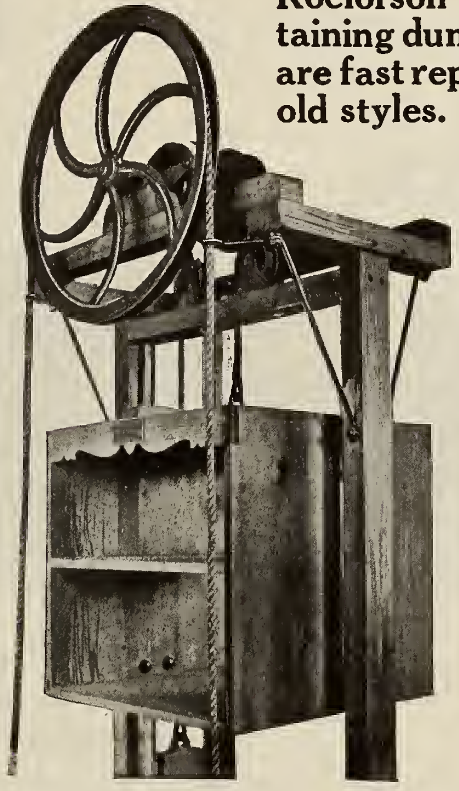
Clamps are easily applied, adjusted and tightened. A wrench releases them. Pull the rods out of the concrete with our Rod Puller.

Write today for Circulars and Prices

Railway Contractors Supply Co.
Standard Bank Building, Toronto
Agents for Ontario and Eastern Canada

DUMB WAITERS

Roelofson self retaining dumb waiters are fast replacing the old styles.



They are so constructed that they will hold the car stationary at any point desired without the use of brake or rope clamp.

We will furnish drawings and estimates of cost for special machines to be used as wall hoists, freight or invalid elevators.

Roelofson
Elevator Works
Galt, Ont.

Canadian Supply & Contracting Co., Limited

Structural Waterproofing, Engineers and Contractors
TORONTO, CANADA

Let Us Tender on Your Roofing, Waterproofing and Flooring Specifications

We supply ROOFING, WATERPROOFING and INSULATING MATERIALS, and undertake contracts for Roofing, Waterproofing, Tar Rock, and Mastic Asphalt Flooring. Our Complete Equipment enables us to execute the work in accordance with Architect's and Engineer's Specifications.

Our work on many notable Canadian Buildings is a guarantee of our ability to successfully carry out the most important contracts.

THE H. & E. PATENT BALL-BEARING LIFTING JACK

For Railway and Bridge Work, Contractors' and Builders' Use

Made by practical Jack Builders. Material: best grades of malleable iron and steel. Fully guaranteed as to durability and efficiency. The long even stroke of the lever together with the design and careful construction of the Jack, makes it the quickest and easiest working lifting appliance on the market. Made in plain and foot-lift styles. Adapted to all classes of work where a lifting jack can be used. Sizes from 8 to 50 tons capacity now complete. Send for prices and discounts.

To any responsible Firm or Railway in Canada any of these jacks will be sent on 30 days trial.

Manufactured by

CANADIAN BRAKESHOE CO., LIMITED
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Sole representatives for the sale of our Brakeshoes in the Dominion of Canada outside British Columbia — Messrs. Taylor & Arnold, Montreal and Winnipeg. The Province of British Columbia—The B. C. Equipment Co., Vancouver.

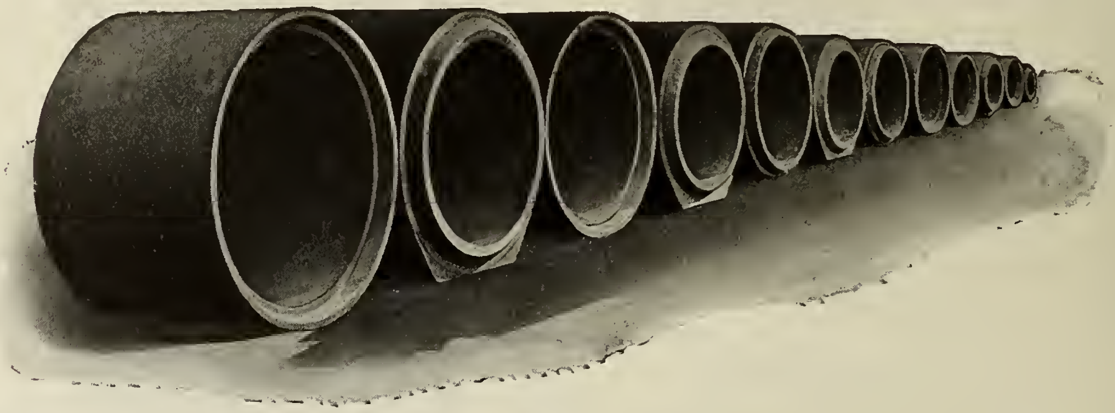
Stock carried by F. H. Hopkins & Company, Montreal

Everything in Concrete and Cement

The most modern plant in Ontario, plus unsurpassed manufacturing facilities and the use of the best raw materials are the forces governing the output of our concrete products. Our manufactures include building blocks, silo blocks, concrete fence posts, railroad pipes, and culvert and sewer pipes.

We make a point of supplying special ornamental trimmings for public buildings, churches and schools.

Your enquiries are respectfully solicited, and will receive prompt attention.



National Concrete Mfg. Company, Limited
LINDSAY, ONTARIO

☛ Erected at Seven Falls, Quebec, Distributor Pipe and Branches, under 450 ft. Head.

Structural and Steel Plate Work

is our specialty. We fabricate and erect from your drawings, or will design your structure for you.

No Work Too Large for us to handle in the minimum of time. May we estimate on your requirements?

WALSH PLATE & STRUCTURAL WORKS, LIMITED

Drummondville, Que. **Holyoke, Mass.**

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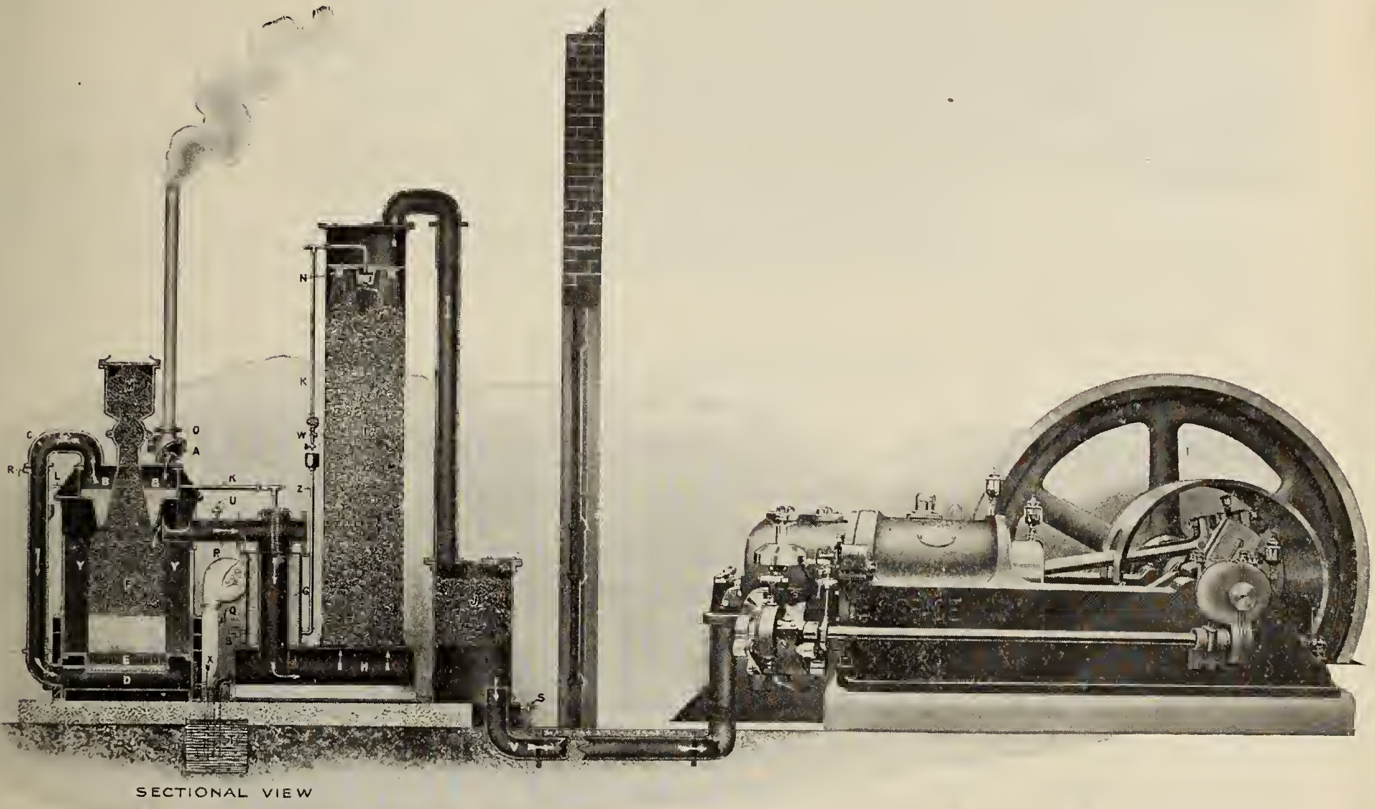
For Operating on Suction, Town or Natural Gas



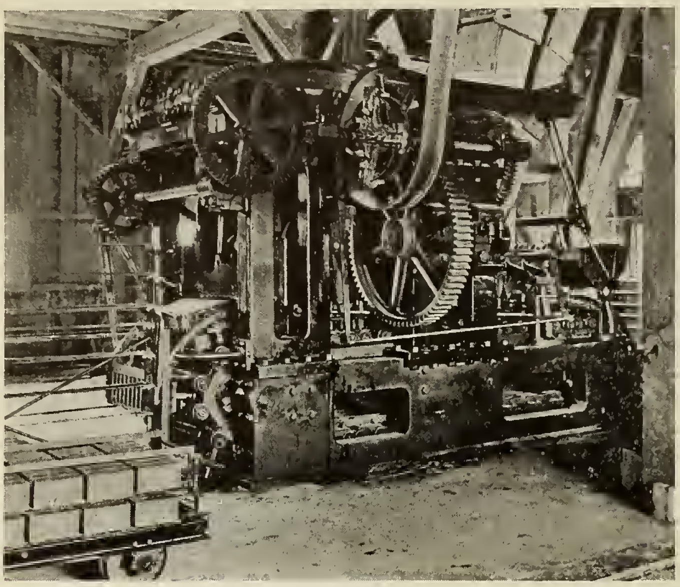
SECTIONAL VIEW

Engines made in all sizes up to 300 B. H. P.

Suction Gas Plants for operating on
Anthracite, Coke or Charcoal

Thousands of these engines and gas producers, working successfully all over the world.

George Anderson & Co. of Canada, Ltd.
617 Quebec Bank Building, MONTREAL



Machine as installed at Mascouche, Que.

Weight 36½ tons.
Capacity 40,000 brick per day.
Exerts a pressure of 3,200,000 lbs. on every eight brick.
This machine is one of the wonders of the age, and is the most modern and perfect ever used in the manufacture of brick products.

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"CONCRETE BRICK"

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"A Perfect Material, A Perfect Brick"

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Manufactured by

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Its Special advantages are:

Strength,
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Builders admit that our Lime takes more sand and is therefore cheaper to use.

Shipped in Bulk or Barrels.

Will give 25% better results to CONTRACTORS, PAPER MANUFACTURERS and OTHERS, than the ordinary lime.

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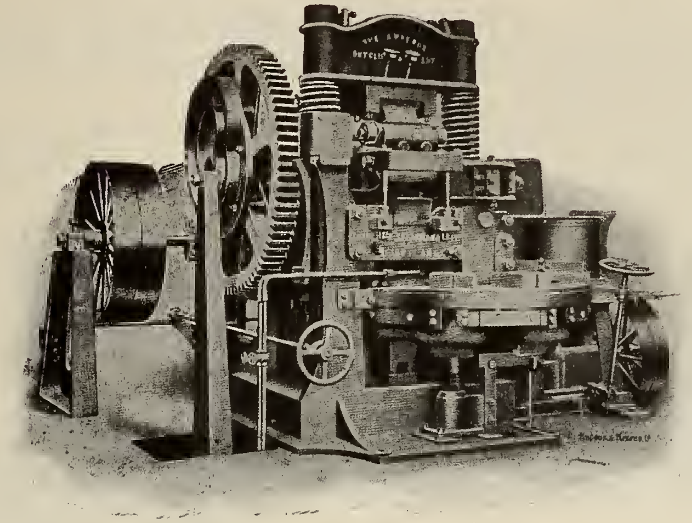

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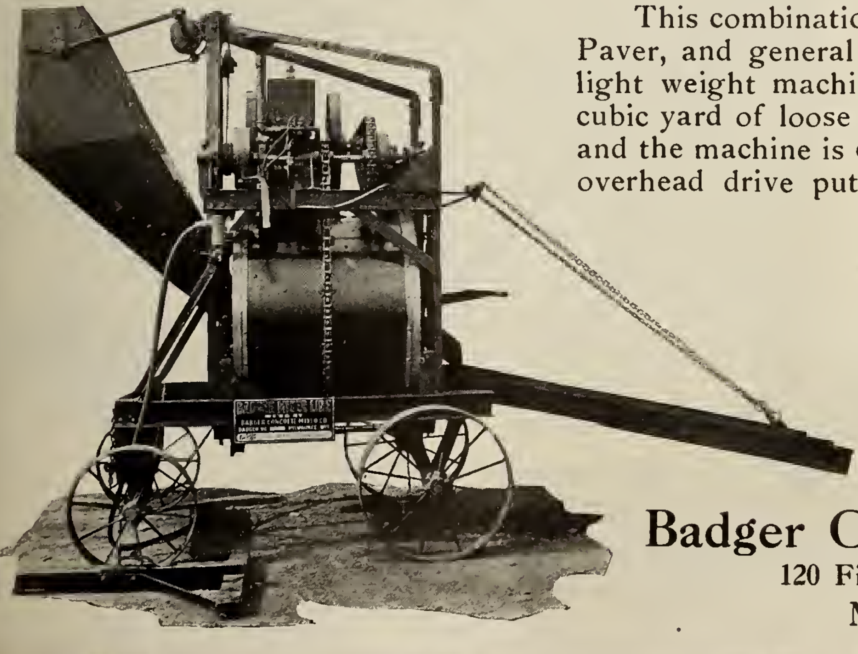
CABLES—"Utilization Leigh" CODES—A B C. 5th Edn. McNeill 1899 Edn. LANCASHIRE, ENG.

Badger Road Builder Street Paver and Mixer



This combination Badger Road Builder, Street Paver, and general purpose Mixer, is an all-steel, light weight machine, with a capacity of one-half cubic yard of loose material. The wheels are high and the machine is easily moved by two men. The overhead drive puts the engine out of the way, enabling the crew to work on all sides. The Badger is the simplest, strongest and best designed road builder and street paver on the market. This is the only Mixer that will meet all the various requirements of the contractor for efficiency and general utility. No vibration.

Write for our prices—they will interest you.

Badger Concrete Mixer Co.
120 First National Bank Bldg.
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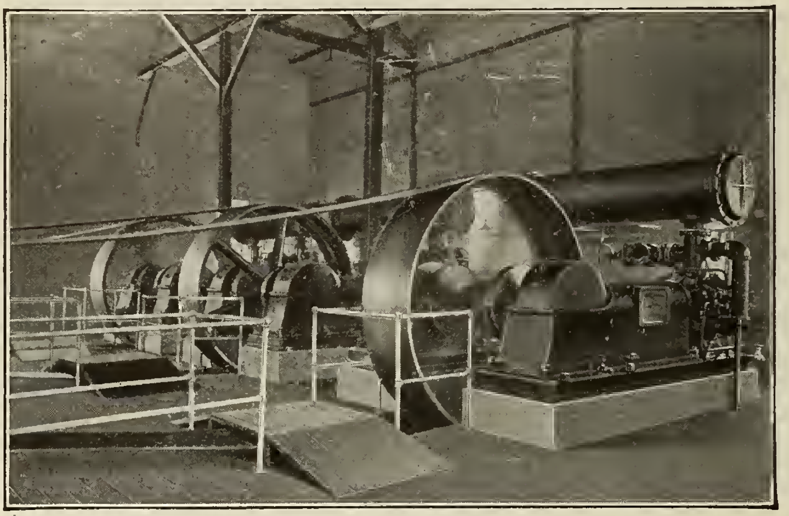
"BLAISDELL" AIR COMPRESSORS



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We build all kind of Cranes for

HAND POWER
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Brickmaking Machinery
Complete Outfits for
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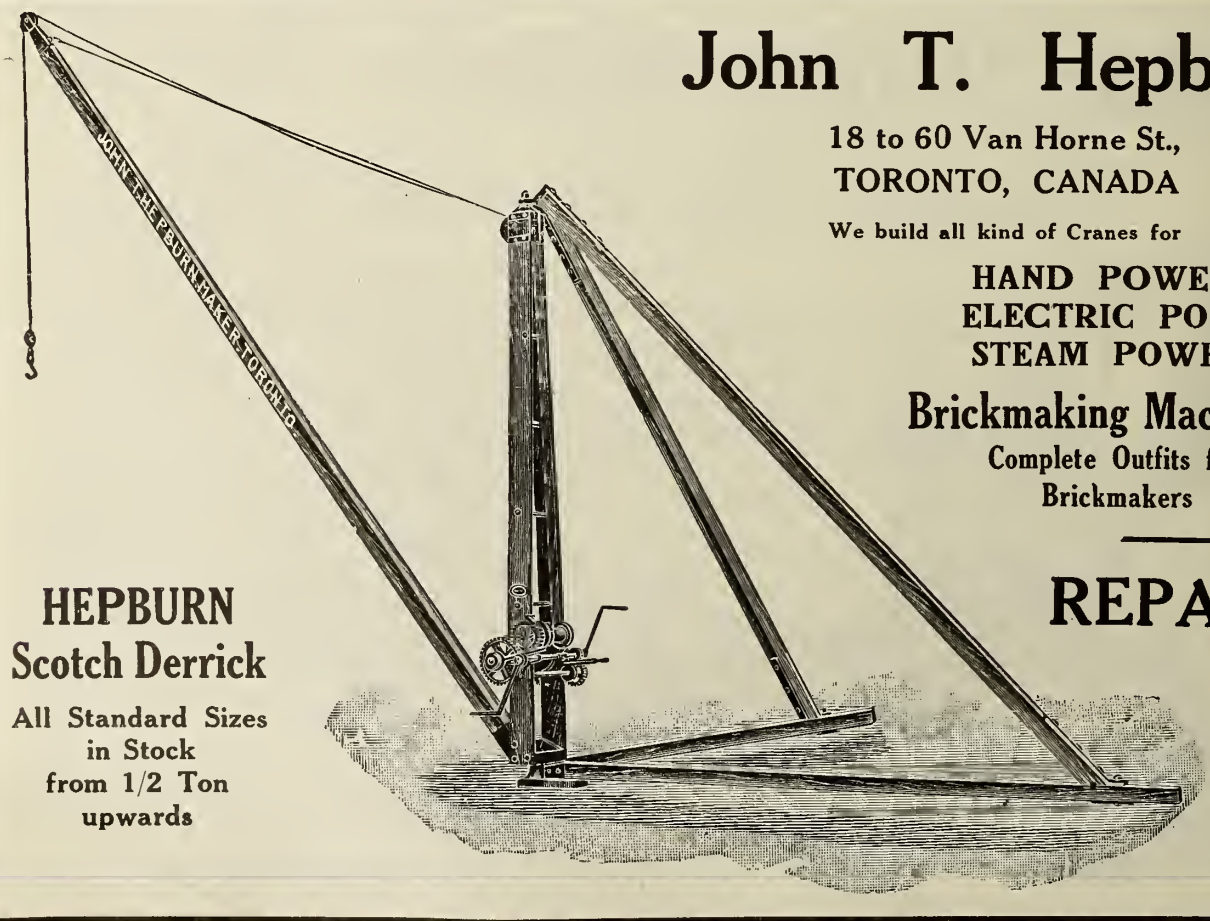
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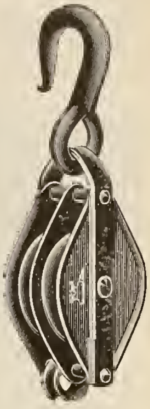

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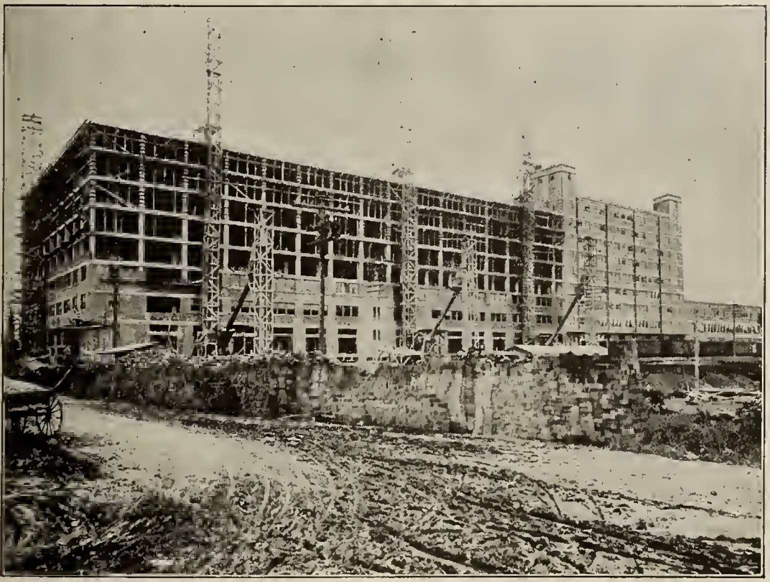

View of Sears-Roebuck Company Building, under construction, Dallas, Texas

REINFORCED CONCRETE FLAT SLAB CONSTRUCTION

(Patented)

The recent decision of the Hon. Chas. A. Willard in the U. S. District Court of Minneapolis in the Drum vs. Turner concrete patent case sets at rest pretended claims of Mr. Turner's imitators.

All infringers are being rigidly prosecuted, as Mr. Turner has in his employ at the present time five of the best known and most able firms of patent attorneys in the United States.

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THE MUSHROOM SYSTEM

is the original reinforced concrete flat slab system and is the only legitimate flat slab on the market today.

For designs, estimates and suggestions embodying the best of our long experience, you have only to consult our Engineers, without any obligation on your part.

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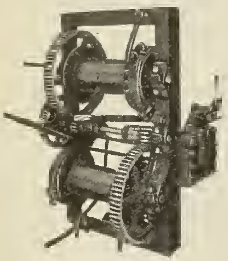
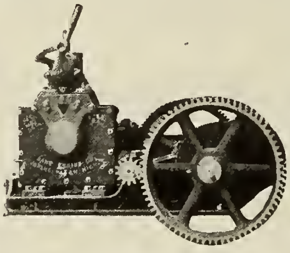


Motor Crab

Write for catalog and prices

Dake Engine Co.
Grand Haven, Mich.



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We are now in a position to offer

"Queenston Blue" Limestone

in Sawn Slabs

as well as Rough Quarried Blocks, Dimension Blocks and all forms of Cut Stone such as Sills, Lintels, Steps, etc.

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Crushed and Rubble Stone

Our quarry has a capacity of 300 tons per day, and with excellent shipping facilities we can supply your requirements in all sizes of this stone on shortest notice.

HUMBER BRICK YARDS
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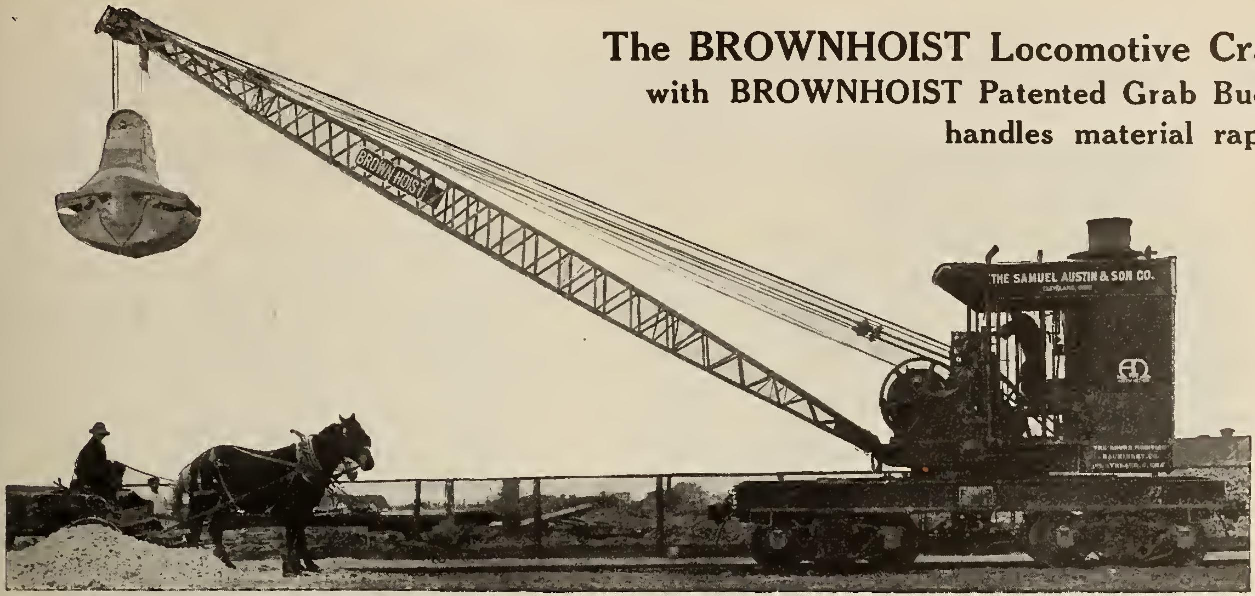
Lake or Rail Shipments **Offices, Works and Docks, TORONTO**



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handles material rapidly

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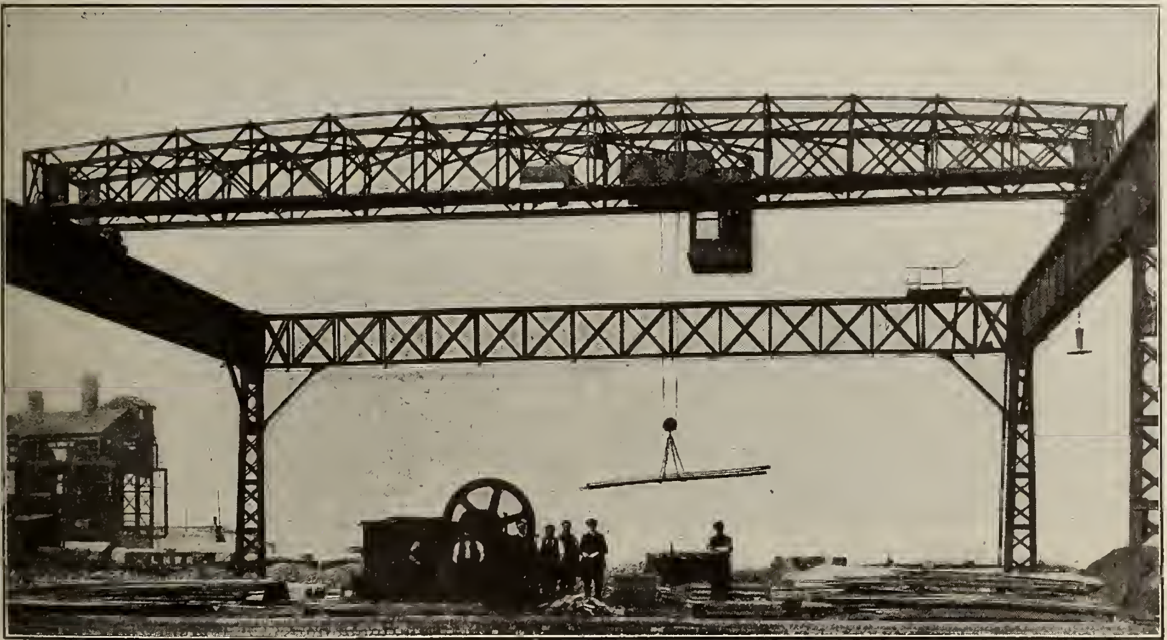

Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

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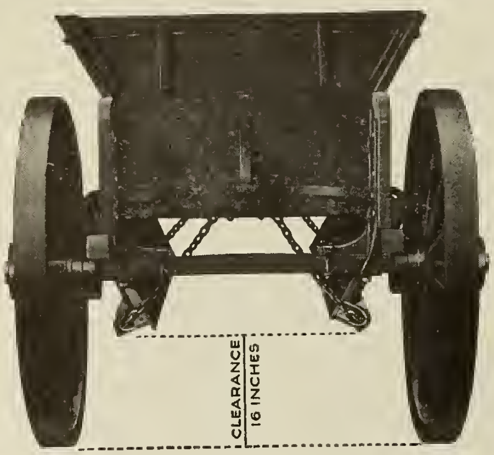

in a dump wagon is the best part of its price. When we chose the Watson Wagon we selected the highest priced dump wagon of the lot. You get exactly what you pay for in this world, and although other wagons can be bought for less we wanted the best so that we could go back to our customers with a clear conscience.

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SPECIFY "Harbour" Sand-Lime Brick

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The right amount of the right material must be provided in the right place.

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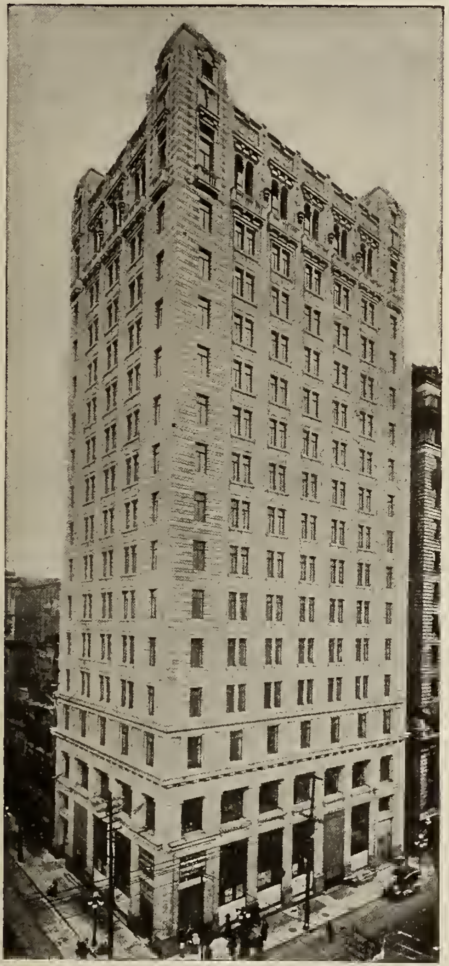

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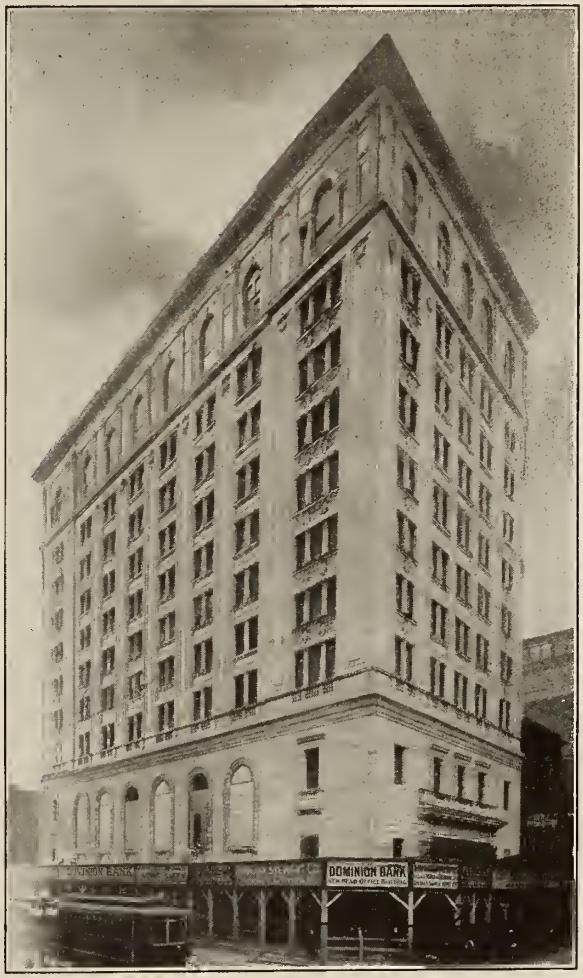

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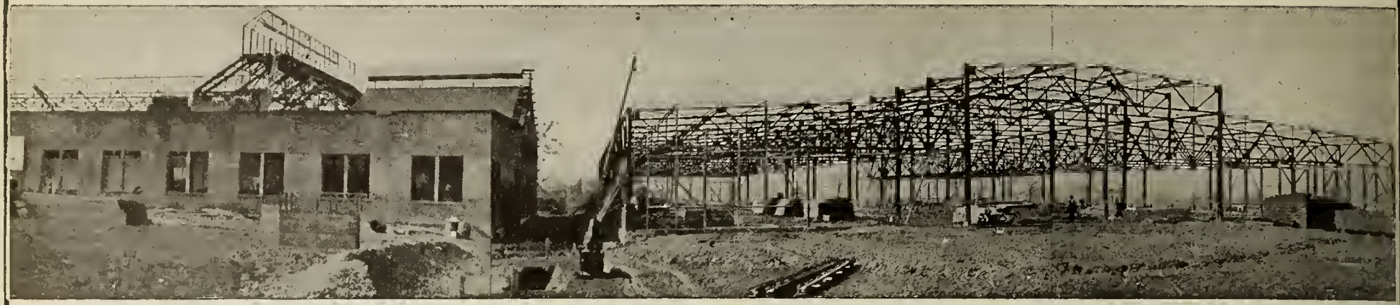

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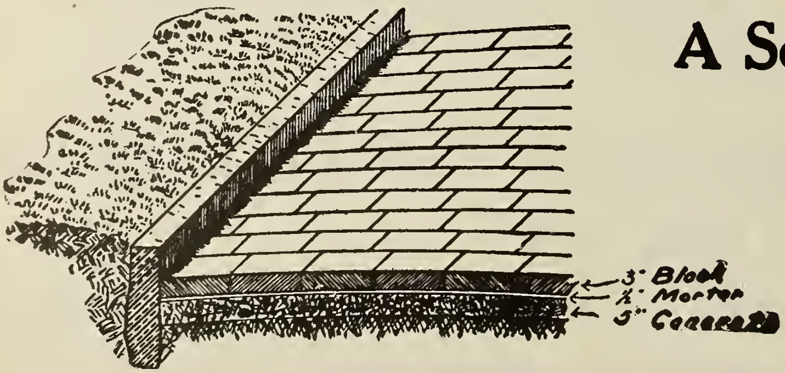

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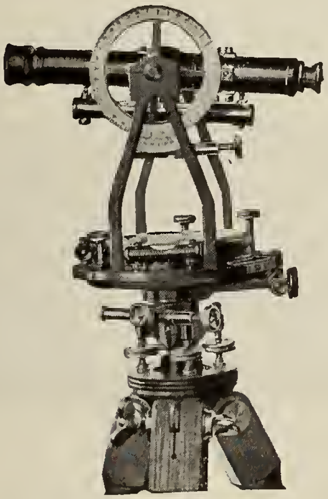

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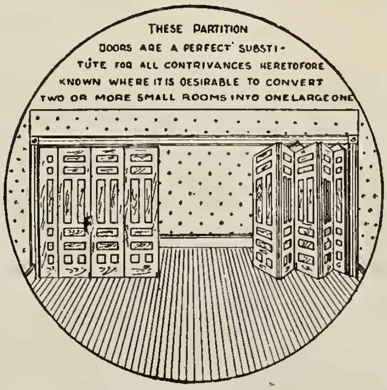
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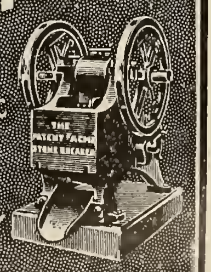
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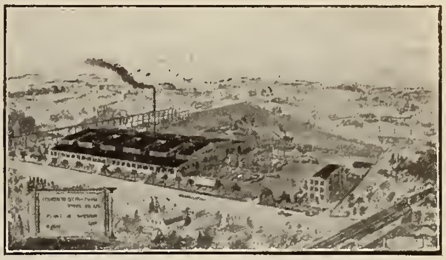

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We carry in stock at Montreal, 8,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

Bridges, Roof Trusses, Columns, Girders, Beams, Towers and Tanks, Penstock.

Estimates furnished promptly. Capacity 18,000 Tons Annually.

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Main Office and Works, Montreal

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STANDARD STEEL CONSTRUCTION CO.
LIMITED
WELLAND - CANADA
MANUFACTURERS AND ERECTORS
STEEL BUILDINGS AND BRIDGES

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Contractors for Waterworks Construction, Manufacturers of Wire-Wound Wood Pipe, Continuous Stave Pipe, Tanks, Silos, Steam Casing.

See our new patented Wood Pipe Coupling—Positively LEAK PROOF.

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Combine Beauty, Strength and Durability.

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SARNIA - CANADA

WE ARE MANUFACTURERS OF

Structural Steel of All Kinds

Railway and Highway Bridges
Steel Buildings

Beams, Channels, Angles Plate
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ESTIMATES AND DESIGNS FURNISHED ON APPLICATION

New Code Rubber Covered Wires and Cables

Manufactured in accordance with specifications of the National Board of Fire Underwriters.

All our new code wire is inspected by the Underwriters Laboratories Inc. and have their inspection tags attached.

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Railway and Highway Bridges

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Structural Steel Work
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OUR NEW OFFICE AND WORKS: 1139 SHAW STREET
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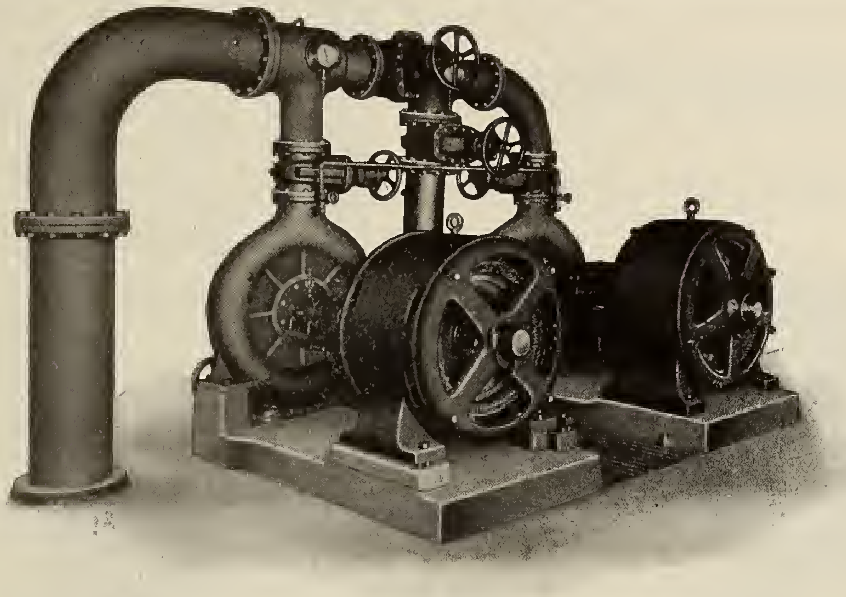
Any capacity or pressure



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Three million gallons, eighty pounds domestic, 160 lbs. fire.

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INSPECTED AND LABELLED UNDER THE DIRECTION OF THE UNDERWRITERS LABORATORIES (INC.)
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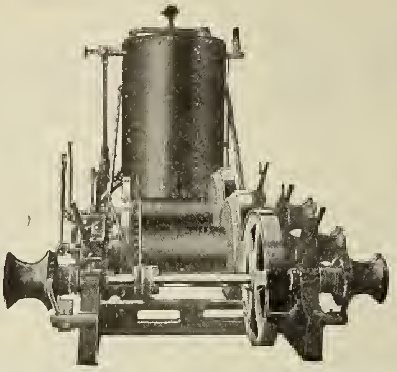

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Standard Hoists and Derrick Irons in stock Prompt Shipment

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Manufacturers of the well-known

TRIDENT Frost-Proof Water Meters

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We manufacture a complete line of high-grade butted tubing. It can be used for nearly every purpose for which you might buy expensive tubing yet it costs less and lasts just as long.

Send us specifications of your requirements and we will quote you prices and send samples by return. There is no obligation, but if we can save you money, surely that is an inducement.

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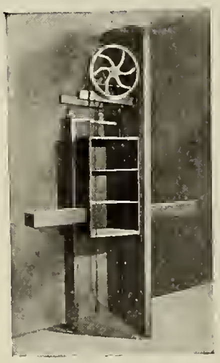

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50 to 150 lbs. capacity.

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DUMB-WAITERS

These dumb-waiters are specially built for high class residence and apartment house service. They are safe speed and easily operated.

Write our agents for prices.

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NEW YORK
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EQUIP YOUR CELLAR

with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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Determine that you will take no more chances on the materials you use. Decide right now that there is but one class of goods which will reflect credit on the work you do.

Some one has said that the best Advertisement a man can have is "Work done well"—we might add "With 'Metallic' Materials."

THE METALLIC ROOFING CO.
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Towers and Tanks for all purposes.

Concrete Mixers

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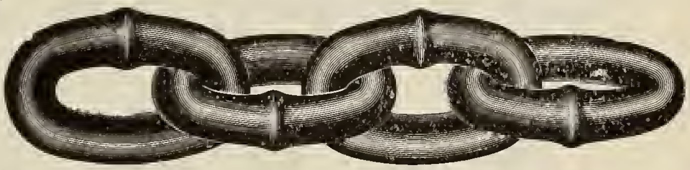

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Is made to precise formulae by weight and mixed by machinery. No guess work. No unreliable labor. It sets quickly and hard, works easily and covers large area. No frost troubles. No cracking.

Put up in bags ready for immediate use by mixing with water only.

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means prompt delivery and high grade materials at standard prices.

WE CAN SUPPLY YOU WITH EVERYTHING THAT GOES INTO YOUR BUILDING, EXCEPT THE IRON AND LUMBER

Toronto Agents for

OWEN SOUND CRUSHED STONE

Deliveries—G.T.R. and C.P.R.

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Built for C.P.R. Montreal

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Chicago Bridge & Iron Works, BRIDGEBURG, ONTARIO

Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.

We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

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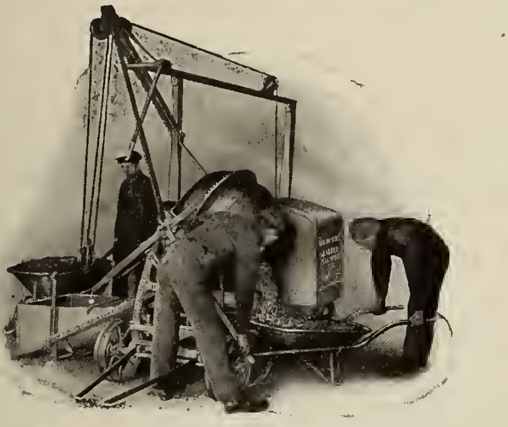
just the Mixer you've been wishing for

The "Big-an-Little"



1914 Model now ready

The small mixer has proved its worth. You know it pays better to have one or more small portable mixers than to mix by hand or to have a great big clumsy mixer. The question has been to get a Dependable Small mixer at a low price.

The "Big-an-Little" is the biggest and best small mixer on Earth, and our Low Prices amaze the Mixer World. They are used everywhere. Write us NOW.

The Jaeger Machine Co.
Columbus, Ohio

Water Purification

RANSOME

Drifting Sand Filters

THIS system has been accepted by the City of Toronto after a thorough test, and a plant having a daily capacity of 60 million imperial gallons is now under construction. The filters can be installed in either the gravity or pressure systems.

Designs and estimates furnished on application.

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ORNAMENTAL IRON WORK
WIRE CLOTH AND WIRE GOODS

Concrete Bonding
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Enquiries solicited.

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Local Agents Wanted in

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Water Filters
1,000 to 1,000,000 Gallons a Day

Refrigerating Machinery
1/4 to 60 Ton Daily Capacity

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4 Gallons to 5,000 Gallons a Day

Refrigerators and Refrigerating Boxes for Ice or Machine Refrigeration
Hotel, Restaurant and Saloon Equipment and Supplies

EQUIPMENT & SUPPLIES, LIMITED
302 McGILL BLDG., MONTREAL, P. Q.

Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $30; sand-lime brick, $8.60, King Edward Siding; $7.50 at the mill; $10.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24.75 per M.; No. 2, $18.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 6 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Toronto prices, delivered on the job:

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge

Steel channels and beams, angles and plates—
$4.
$2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

PAINTS AND OILS

White lead—ground in oil, $8.75 per 100 lbs.

Boiled linseed oil—in bbls., 64c per gal. of 9 lbs.

Raw linseed oil—in bbls., 61c per gal.; red lead, dry, $7 to $8 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 70c.

MONTREAL PRICES

CEMENT, LIME AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $24, red $24, buff $25, white $47, plain pressed $12 per thousand, all f.o.b. Montreal. Quotations f.o.b. Toronto:—White $52.50, buff $30, grey $27.50, plain pressed $17.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 15c basis per pound; British manilla, 11c basis; sisal rope 10½c basis. Boiled linseed oil—in barrels, 66c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents; 2 cents reduction per bushel on lots not less than 1,500 lbs.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, $13 per cord.

Sand—For cement or brick work, f.o.b. Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

(Continued on page 106)

RAILS BILLETS

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

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(Continued from p. 104.)

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

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Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.85 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Harner Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $8.85 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

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CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand $1 per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

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Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

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Vancouver prices f.o.b. warehouse:

Steel—(round and spuare bars) $2.50 base; twisted and deformed, $2.75; structural sections, $3.00 to $3.50.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.00 to $3.50, per 100 lbs., depending on size, quantity and specifications.

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Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

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Hydrated lime—$14 in car lots.

Plaster of Paris—Windsor brand, $4.50 per bbl.

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Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 85c per gal. of 9 lbs.

Raw linseed oil—in bbls, 83c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

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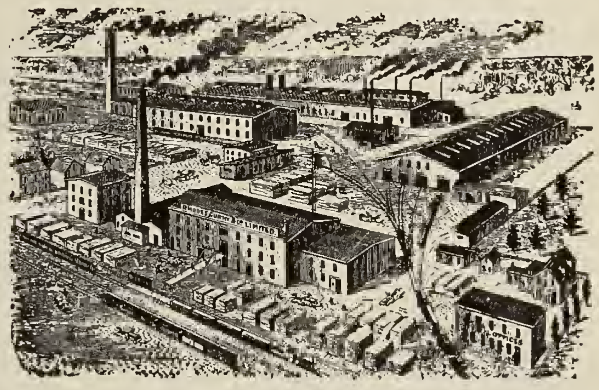

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Job No 1006 Picture No 8 Date 5-27-14
Title Piers 3, 4, 5 and 6
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The above piers were built by dredging open caissons through sand, clay and gravel to a firm foundation, the deepest being founded 86 ft. below High Water Level. A 24 ft. tide at this point greatly added to the difficulties of construction which was carried out through the most severe winter weather.

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Buffalo Single Cylinder Double Acting Power Pump

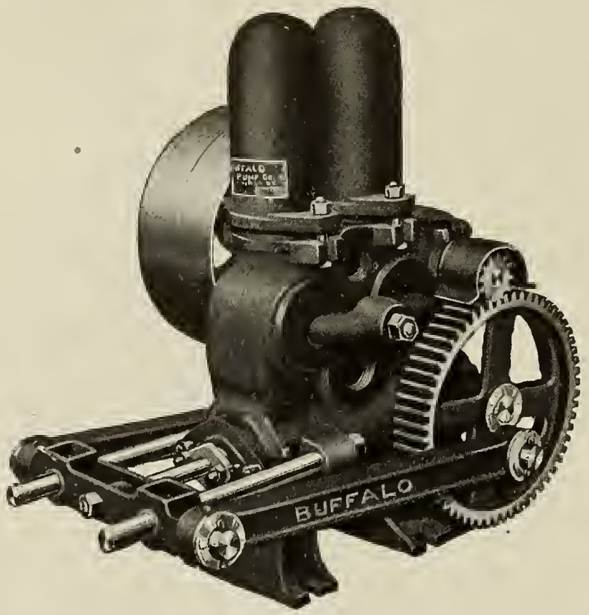

Fig. 401

The power pump illustrated is a distinct departure from the older competing designs now on the market. It will be noted that both the suction and discharge openings are above the cylinder. Because the suction valves are above the water piston the water contained cannot leak out when the pump is stopped. In other words the pump **always stays primed** and will immediately pick up its suction after a long period of rest because the cup leathers will not have dried out. This design is by far the best for handling water through long suction pipes and for the greatest convenience of operation. Two large air chambers are provided directly above the discharge valves where they are doubly effective and as they are easily detached the discharge valves are easily accessible. The suction valves are reached through two cover plates both of which may be taken off by removing one nut.

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Pump cylinders are brasslined, valves, valve seats and gland are brass; piston rods are brass fitted.

All bearings are lined with high grade babbitt and provided with large grease pockets with hinged covers.

Suction and discharge openings are provided on both sides of the pump.

Built in sizes 10 to 100 gallons per minute.

Send for Circular No. 255-C12.

Buffalo Steam Pump Co.
Buffalo, N. Y.

—Sole Canadian Agents—
Canadian Buffalo Forge Co., Limited
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White Lime — Gray Lime
Stone — Drain Tile — Brick

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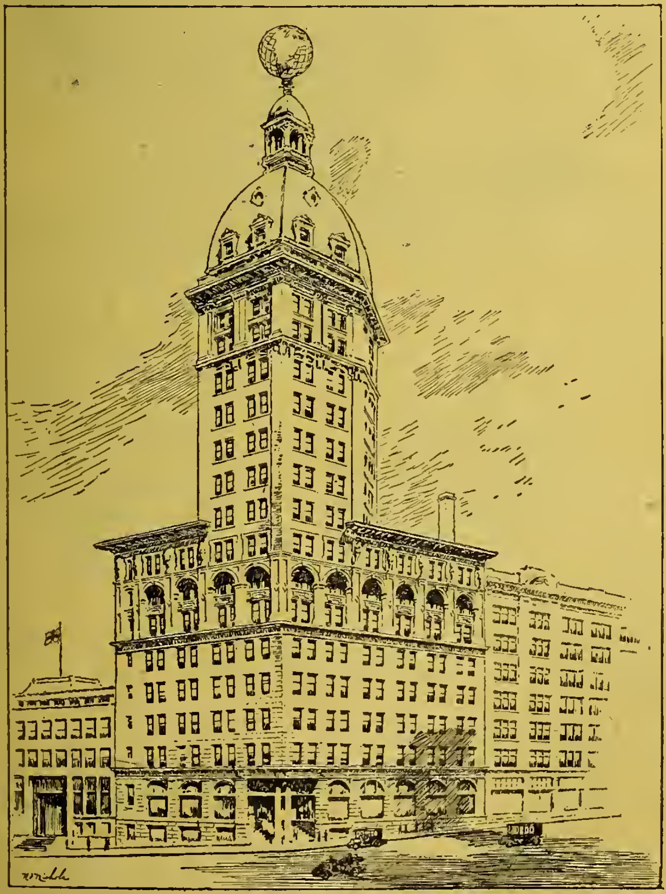

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This building was wired with
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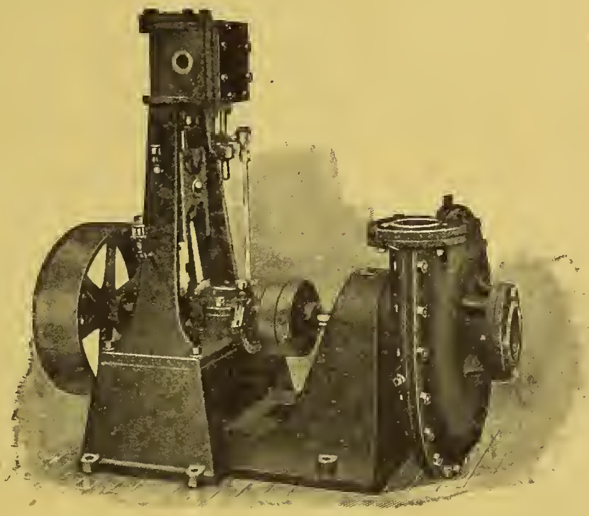
Vol. 28 Toronto, August 26, 1914 No. 34

Contract Record and Engineering Review

ESTABLISHED 1886

Smart-Turner Pumps



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Estimates furnished on all classes of electrically driven, steam driven and centrifugal pumps.

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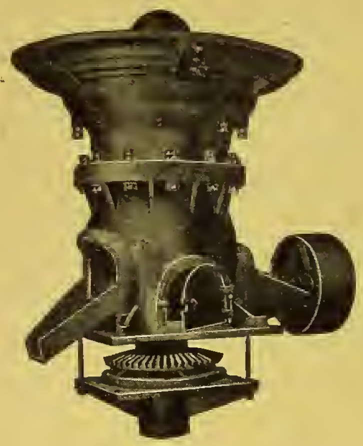

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We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

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Sheaves In Hard-to-get-at Places Should be Equipped with

"American" Self Lubricating Bushings

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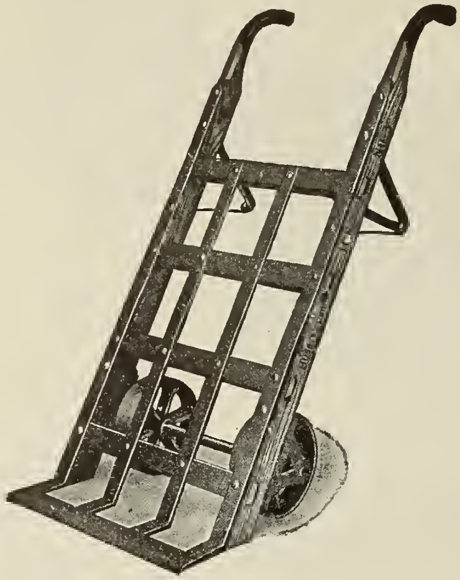

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Equipped with
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***For Heavy
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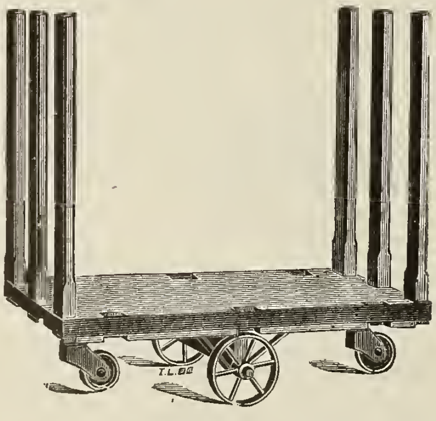
Light Work***



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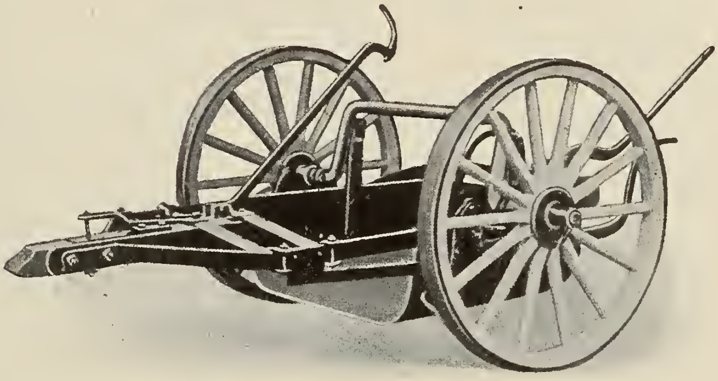

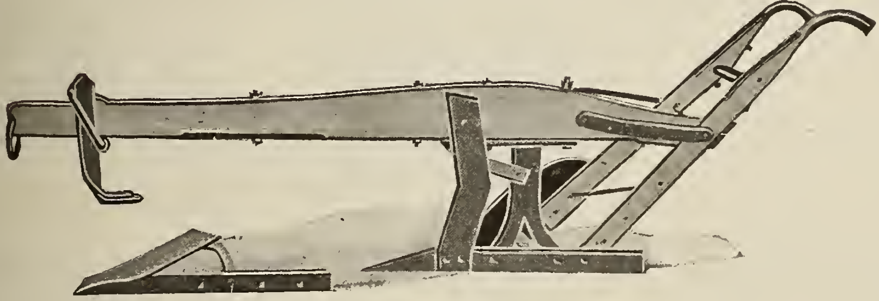

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(Continued on page 12)

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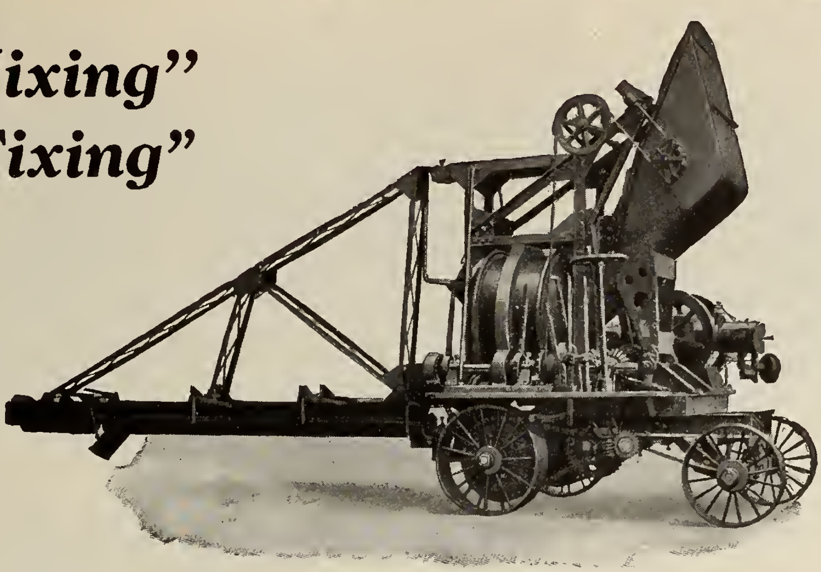
"Least Fixing"



M-C Rail-Track Paver, With Gasoline Engine, Showing Mixing Distributer.

M-C Rail-Track Paver

Points too valuable to overlook. Compare them with those on other machines. That's all we ask.

Traction	12 horse-power steam or gasoline engine; Two speeds ahead, one speed reverse; Heavy brakes like on auto trucks; Powerful differential; Extra large wheels; Right height to pass under city viaducts; Drives like a traction engine, up hill or down; Sell your horses—you don't need 'em.
Operation	Perfect one man control; Engineer works in one natural position; No stooping or stretching; Engineer rides when traveling; Levers all at fingers' ends; No expert needed to handle distributer; Safety first—gears covered.
Capacity	Continuous mixing; 11 to 12 cu. ft. of wet mixed concrete, or 2 bags 1-3-5 per batch; Daily capacity, 1200 to 1400 street yards, 6 ins. thick.

Mechanically, the M-C Rail-Track Paver is as well built as we know how to build it. It has all the strong features of the M-C standard mixers:—**Semi-steel Drum, Steel Rail Tracks; Segmental Gear; Dustproof Roller Bearings, Etc., Etc.**

Send for free catalog explaining it in detail

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The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

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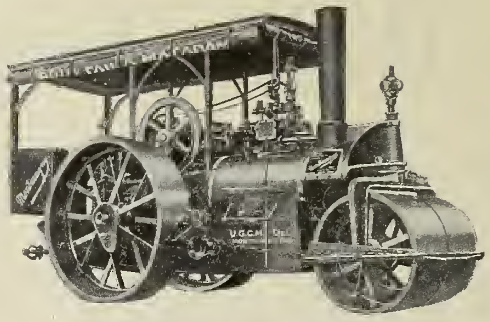

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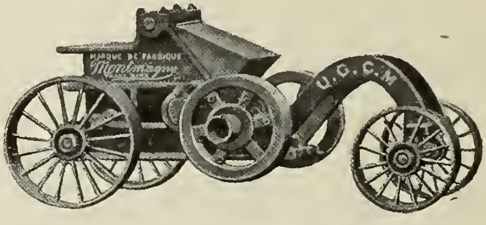

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Of course, they used CERESIT TRADE MARK **The Dependable Waterproofer for Cement**

It was an unusually hard task to waterproof the boiler room of the Parkway Tea Room, Chicago, (here shown). Heavy water pressure and quicksand were to be overcome. But Ceresit has kept the boiler room perfectly dry, just as it has done in hundreds of basements, pits, and other underground structures. To be absolutely sure, use Ceresit when conditions of dampness or water pressure are to be encountered. Our 1914 "Book of Evidence" gives complete details. Write for it.

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in the end—why not
now?

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It spells longer life, less repairs, no breakdowns, constant service, greater output, and lower operating and mixing cost. On the next job use the

"INTERNATIONAL"

Concrete Mixers

**GLOBE
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Some New Improvements worth investigating:

Globe Drum, Steel Tracker Bands, Self Oiling Winding Drum and Tracker Wheels, Steel Chain Drive

Write to-day for complete Catalog
No. 60-98 and prices.

Large stock carried for immediate delivery

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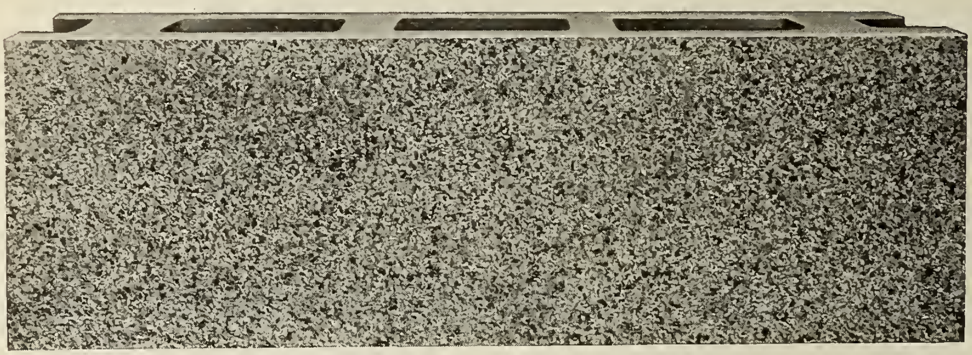
10 sizes, 4 to 100 cu. ft. per batch. Any power.
Agents wanted in open territory. M325.4

Zagelmeyer System

OF CASTING

Hollow Cement Building Blocks

With Granite Faces



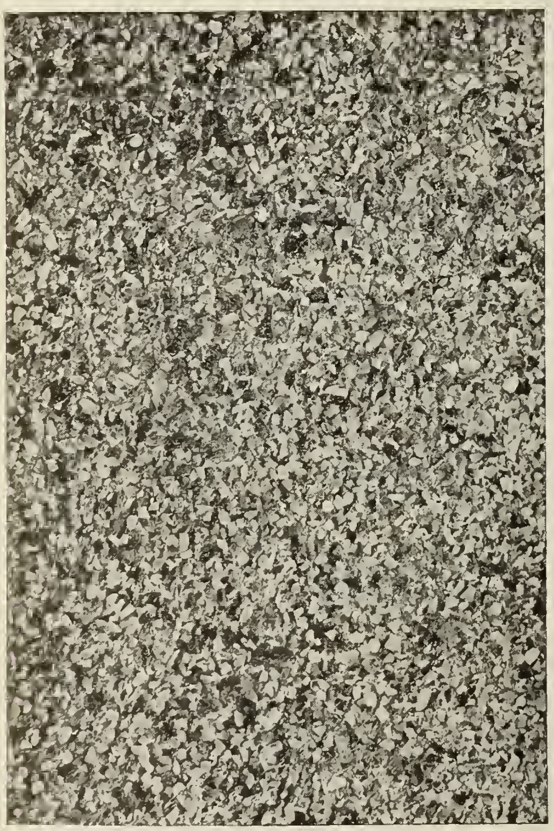
8 x 8 x 24 inch Granite Smooth Face Block

They cost less

They sell for more

You sell more of them

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



Enlarged View of Granite Smooth Facing

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold or moisture.

8 x 8 x 24 inch Granite Rock Face Block

Send us fifty cents and we will send, freight prepaid, to any point in Ontario, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

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What show will you have if your competitor secures the exclusive right for this system in your city?

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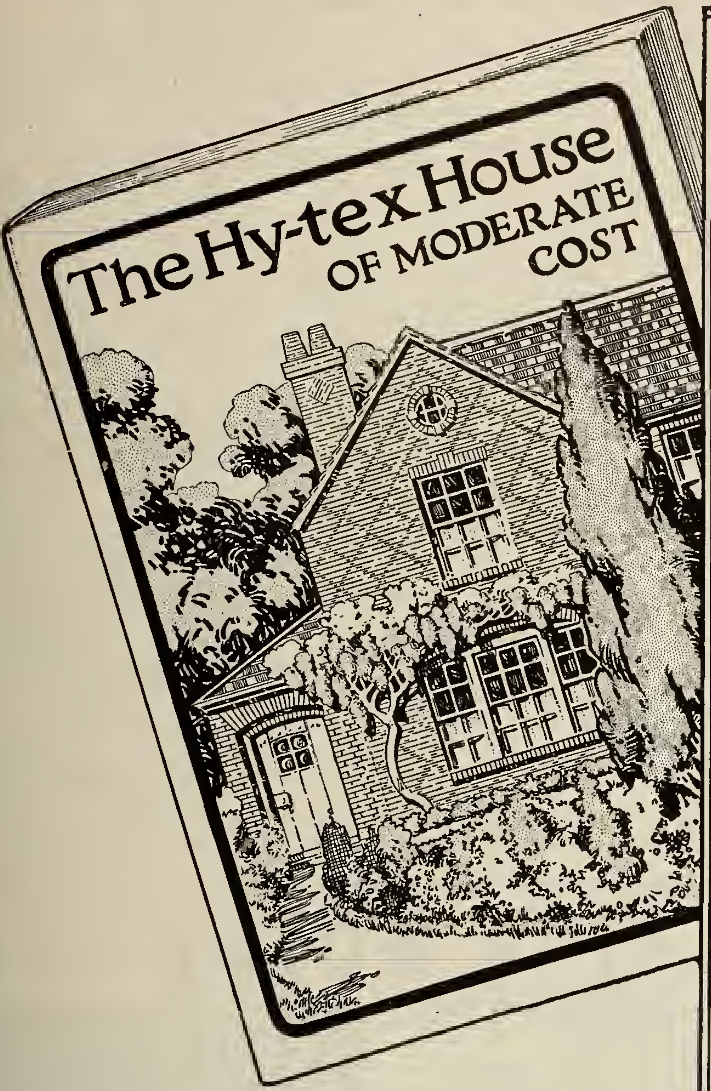
Get into a business that is protected. Then you will make money.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Canadian Zagelmeyer Co.

Limited

298 Howard Ave., Windsor, Ontario



The architect always has use for house plans, both as material for comparative study and as points of departure for original work of his own. Particularly is this true when the plans offer a great variety of suggestions in recent work of many well-trained designers. Such a suggestive collection of fresh, able work is "The Hy-tex House of Moderate Cost," a new book of ours just off the press.

This book contains a selection of designs submitted in a competition conducted by The Brickbuilder during the early part of this year. Nearly four hundred architects and architectural draftsmen representing one hundred and thirty-three cities, scattered throughout forty states, and six cities in three Canadian provinces, took part in this contest. The competition was judged by five well-known architects from the Middle West,—Arthur Heun, Chicago; Edwin Hawley Hewitt, Minneapolis; John Lawrence Mauran, St. Louis; Frank B. Meade, Cleveland; and W. D. Wight, Kansas City.

The designs presented in this book typify the best thought in modern domestic architecture in both elevation and plan and fairly represent the results that may be obtained in a brick house costing $7,500. As will be appreciated, a house can be built from these designs at a lower cost by scaling down, or they may be developed to a greater or less extent, depending upon the requirements of your client.

"The Hy-tex House of Moderate Cost" will be sent to any architect upon application to us or any of our branch offices.

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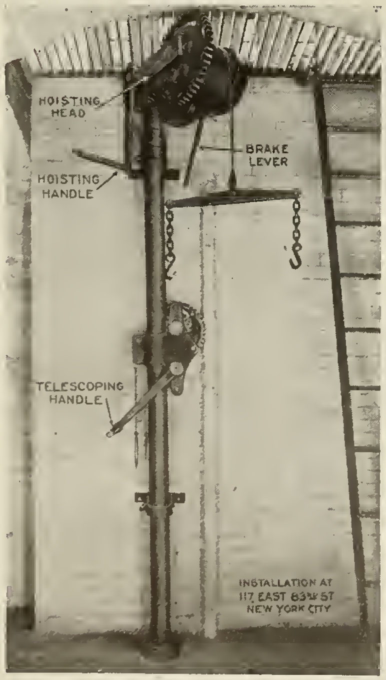
G & G TELESCOPIC HOIST (PATENTED)



Compact—easy to erect. Takes up no room in basement.

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.

1.—It is telescopic—no part showing above sidewalk when not in use.
2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.
3.—Simple in construction and absolutely rigid when erected.
4.—It is made of strongest and most durable material.
5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.
6.—A powerful ratchet device is provided with both handles above mentioned.
7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.

Gillis & Geoghegan

544 West Broadway
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Hoisting head revolves. Can is deposited on Sidewalk without lifting.

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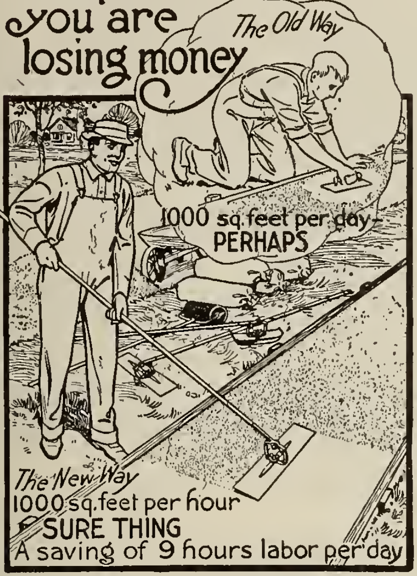
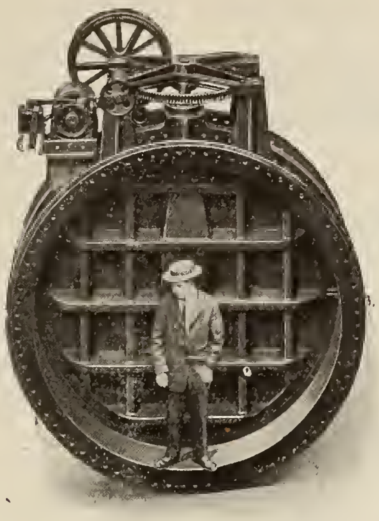
If you are not using "ABRAM" TOOLS It is plain to be seen you are losing money


The Old Way
1000 sq. feet per day—PERHAPS
The New Way
1000 sq. feet per hour
SURE THING
A saving of 9 hours labor per day

Abram Cement Tool Co.,
Windsor, Ontario



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PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.
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must be built of a
Tough Stone
that will cement
WE HAVE IT

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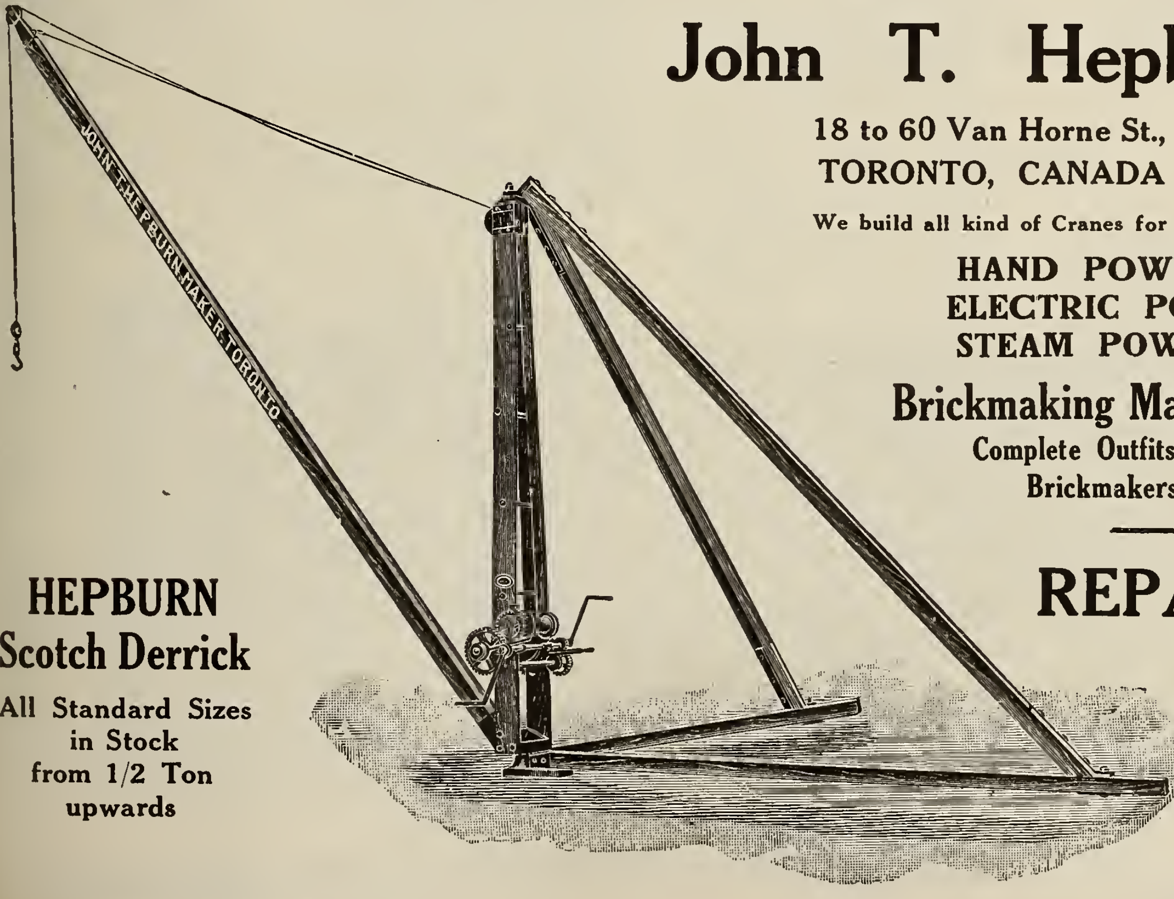
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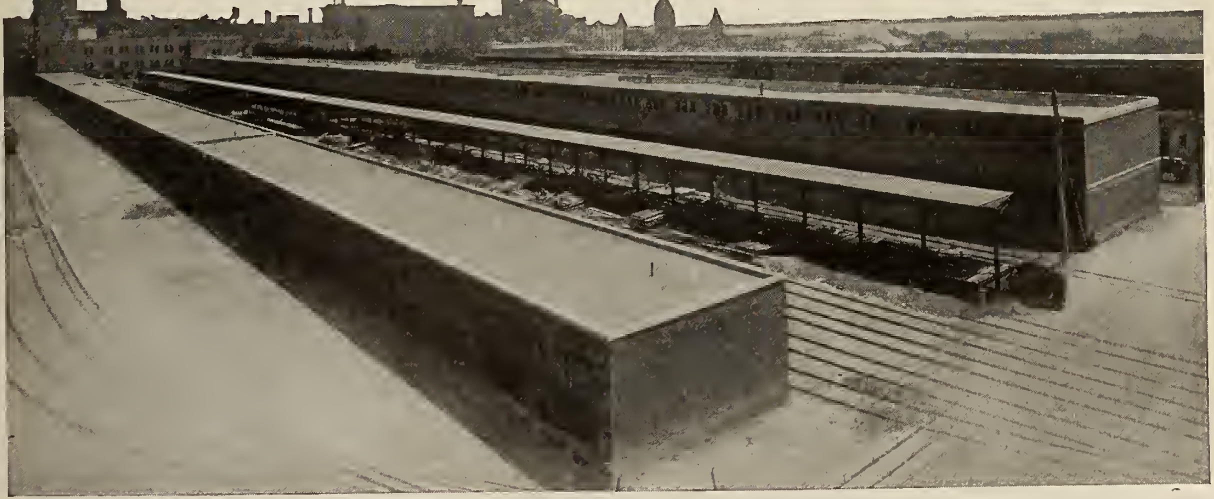

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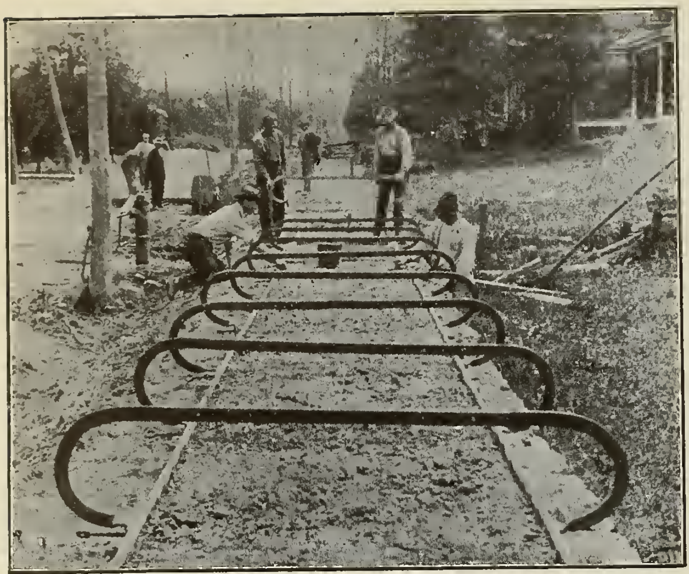

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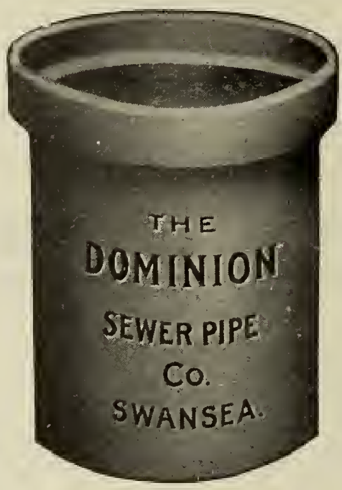

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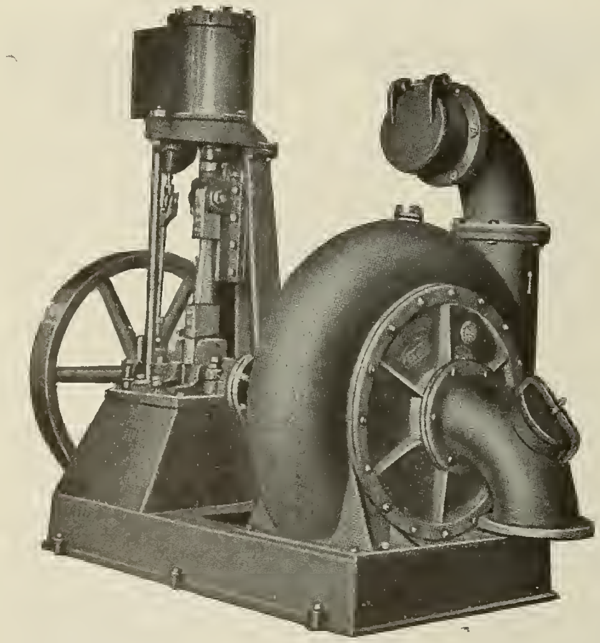

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Complete Hydraulic Dredging Machinery
Centrifugal and Turbine Pumps for
Every Service

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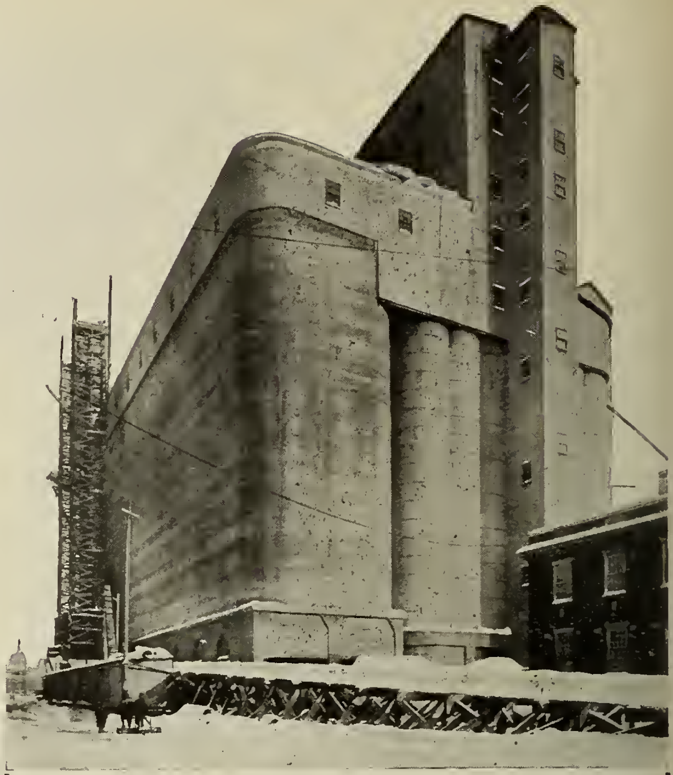
Canadian Sales Agents—
Storey Pump and Equipment Co., Ltd., Toronto, Montreal



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The best sheets on the market for
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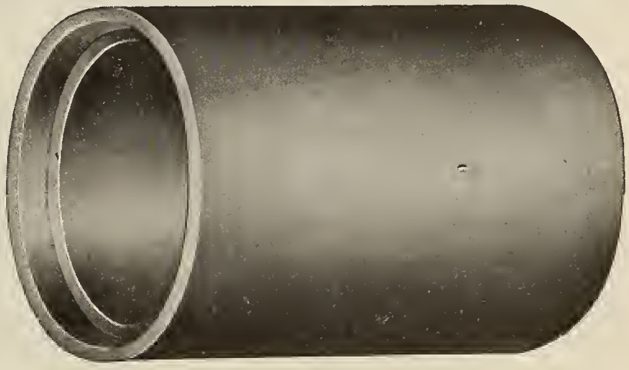

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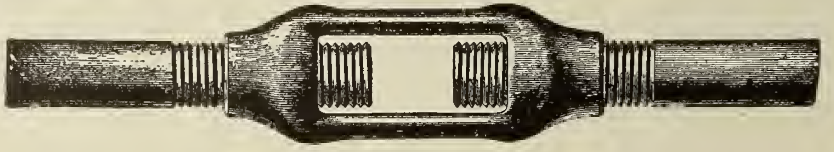

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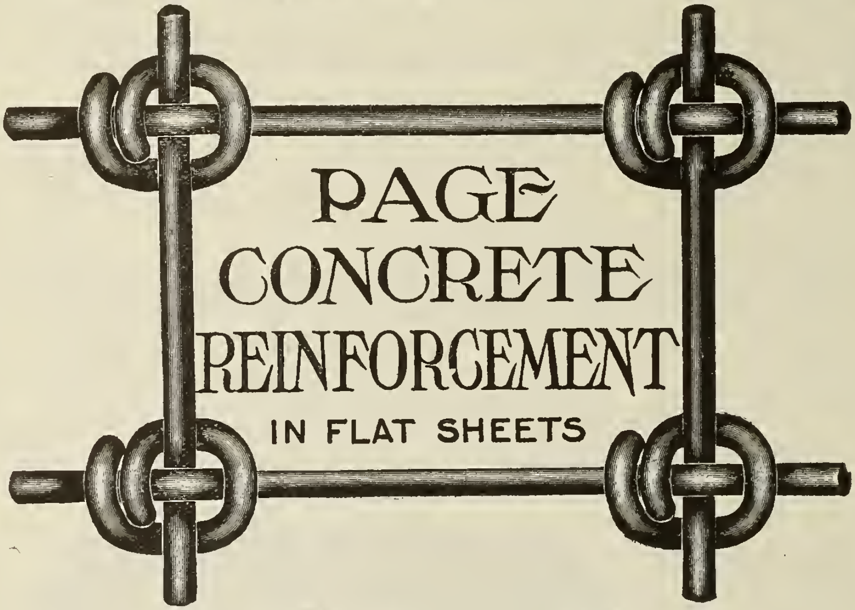

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The
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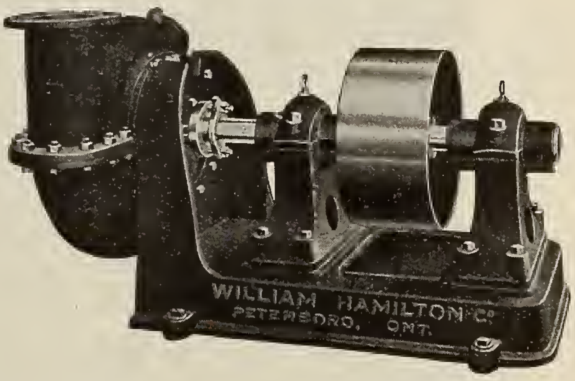

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They are built in all sizes from 2-in. to 14-in. discharge.

Ask for pump bulletin.

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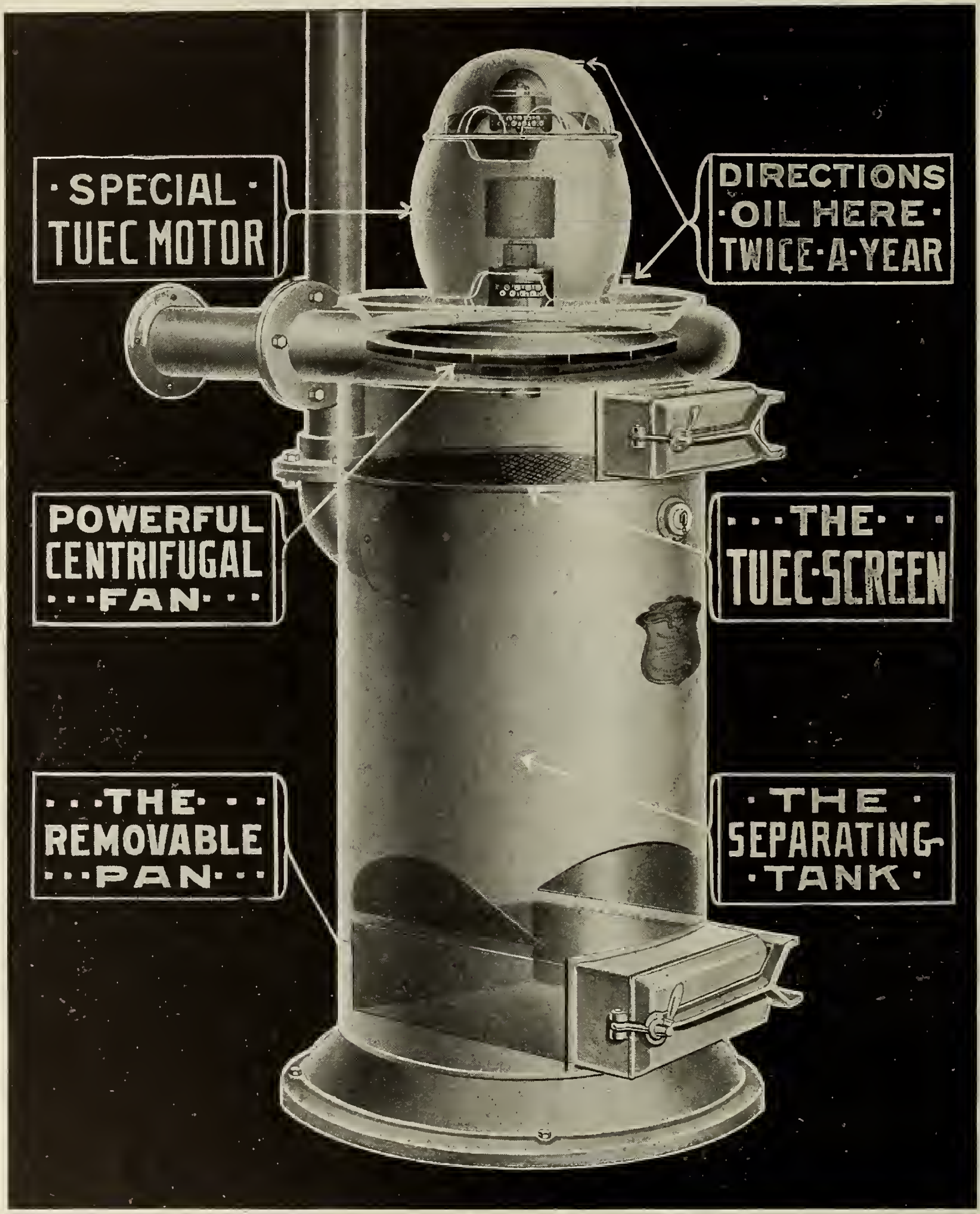
Simplicity — Economy — Durability



See Tuec Machine demonstrated at Machinery Hall, Canadian National Exhibition, Toronto, August 29—September 12.

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Manufacturers of

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(Annealed and Unannealed)

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A chemical compound in powder form, which when used to the extent of two per cent of the amount of neat Portland Cement used, will waterproof Elevator or Boiler Pits, Reservoirs, Foundation Walls, Cement Stucco, etc., etc.

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6 small bench shots like this—each one stopping work of the steam shovels, dinky engine crews and cars—and laborers.

or

One big face blast—one stop for shovels, engine crews and cars as done by

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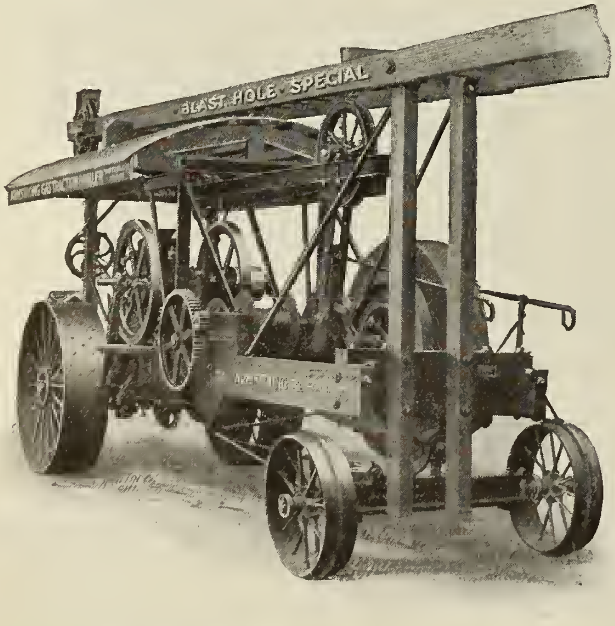
BLAST HOLE DRILLS
BUILT FOR SERVICE SINCE 1867

Special Blast Hole Cable Drills

A FEW WORDS ON BLAST HOLE DRILLING

Economical blast hole drilling is a matter of getting the greatest footage of hole drilled in the shortest time with the least possible cost. The blow of the falling string of tools is the real factor in the case, and upon the conditions surrounding the action of the drilling tools depends the economy of the process. With a given weight of tools, the speed of drilling depends upon the length of the stroke, to be more exact, the actual height of drop of the tools, and the number of strokes per minute which can be freely made. These two conditions are vital to rapid and efficient blast hole drilling and are made nearly 100 per cent efficient in the "Special Armstrong Blast Hole Drill."



This is how we do it:

The "Special Armstrong Blast Hole Drill" embodies an important feature of design not found in any other type of cable drill made today, which makes possible the wonderful records which it is achieving in quarries throughout the country. The above mentioned improvement lies in the straight crank motion of the spudding beam and the proper location of the spudding sheave. It eliminates the "whipping" of the cable, it increases the lift of the tools on each stroke and makes possible a greater number of strokes per minute for a given crank throw and gives an absolutely free drop to the tools. In other words, it makes more efficient the two conditions which are required for rapid drilling, the greatest number of powerful blows; in other words, the maximum foot pounds of energy delivered at the bottom of the hole, within a time limit.

We can prove with authoritative records covering in detail periods of six months' duration that the increased efficiency of the Special Armstrong Blast Hole Drill is from 40 to 50 per cent over similar sized cable drills of other makes.

Fundamentally and finally, this machine is built for *BLAST HOLE* purposes only. It is not a well drill. We do not furnish it for any other purpose than drilling blast holes. Let us know your conditions and we *absolutely guarantee* an increased footage per day or over a long period at a lower cost.

Write for Bulletin S. giving data and records, and let us have an opportunity to prove our case.

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Waterloo, Iowa, U. S. A.

Eastern and Export Office
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New York City

Western Branch
3rd and San Pedro Streets
Los Angeles, Cal.

Canadian Branch: Drinkle Block No. 2, Saskatoon, Sask

All Over North America the popular RED Brick is

"PRESSED BRADFORD BRICK"

(TRADE MARK REG. U. S. PATENT OFFICE)

Their destinctive, non-fading redness appeals to persons of discrimination.

"Bradford Reds"

the trade name for our smooth brick, made both dry pressed and impervious.

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Our rough-textured brick for bungalows, grills and fine rustic effects.

Write for the RED Catalog.

Bradford Pressed Brick Company

"The Red Brick People"

BRADFORD, Pa.

Dowling Ave. Highway Bridge, Grand Trunk Ry., Toronto Can.
Waterproofed with J. M. Waterproofing Materials

Some of the largest and most difficult waterproofing jobs ever attempted

have been planned by our Engineering Department and executed under their supervision by our trained corps of workmen.

This can mean but one thing—that we have the proper facilities and materials for undertakings of this character.

You can be absolutely sure of results on your next waterproofing job if the work is done by us, with

J-M WATERPROOFING MATERIALS

These materials are made of non-organic substances, therefore are practically proof against deterioration. They give lasting protection under all conditions of weather and climate. Will not crack, run, shove or disintegrate. And are not affected by expansion or contraction caused by settling walls.

No matter what your waterproofing problem may be—bridge, abutment, reservoir, residence, business structure or church—we will gladly co-operate with you.

Write our nearest Branch for Booklet.

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Manufacturers of Asbestos Roofings. Stucco Pipe Coverings, Cold Storage Insulation, Waterproofing, Sanitary Specialties, Acoustical Correction, Cork Tiling, etc.

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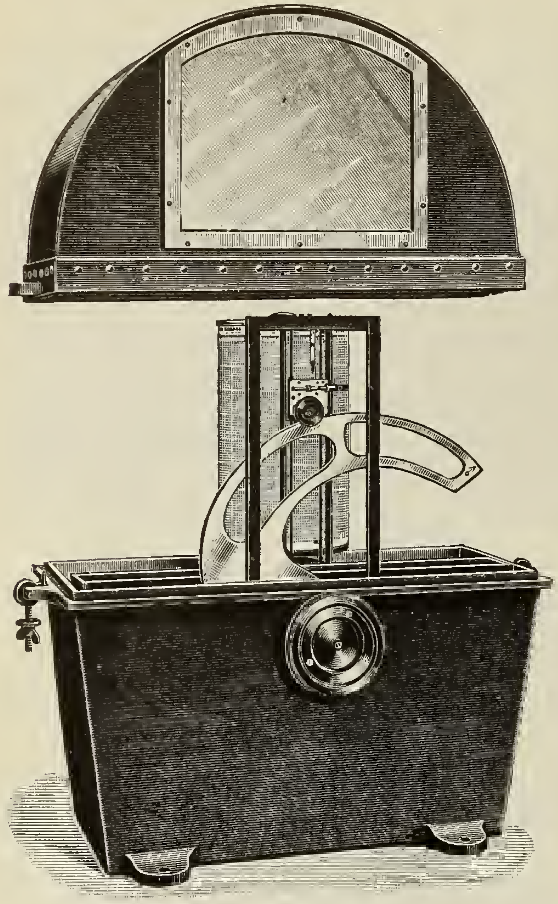

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For recording the quantity of water or sewage flowing over a sill or through a notch. A strong, reliable instrument, not liable to derangement, and of the best manufacture and finish. Easily installed because no elaborate levelling is required.

Send for Book No. 6

which contains fullest information about all classes of Water Level Apparatus.

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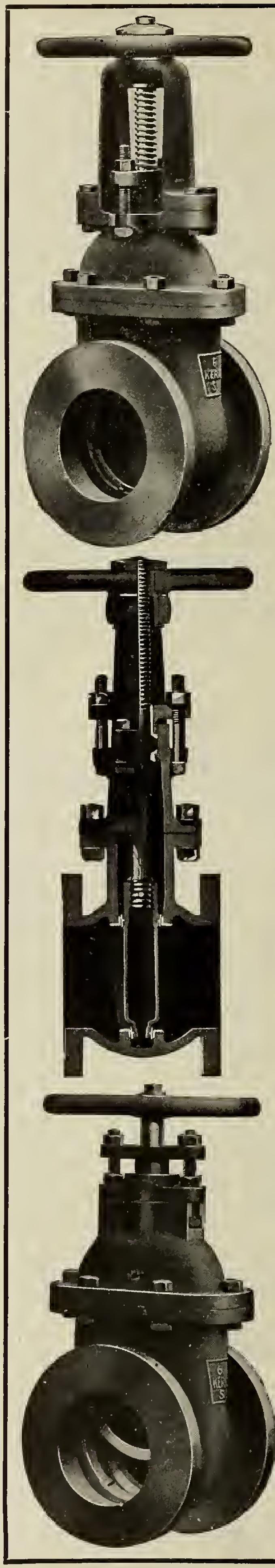
Leicester, England



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"Keystone"
Iron Body
GATE
VALVES

are not surpassed by any other gate valve in **Design, Quality** of material, **Durability, Workmanship,** and up-to-the-minute requirements.

They have been designed and are built to meet the specifications of the most exacting and critical Engineers, and will bear the rigid scrutiny of "THE MAN WHO KNOWS."

If you are particular about the valves you specify or buy, you will not only **specify, but demand Kerr (Keystone) Iron Body Gate Valves.**

Any **Kerr Valve** lends class and distinction to any steam or water job.

Manufactured and Guaranteed by

The
KERR
Engine Company
Limited
WALKERVILLE, ONT.

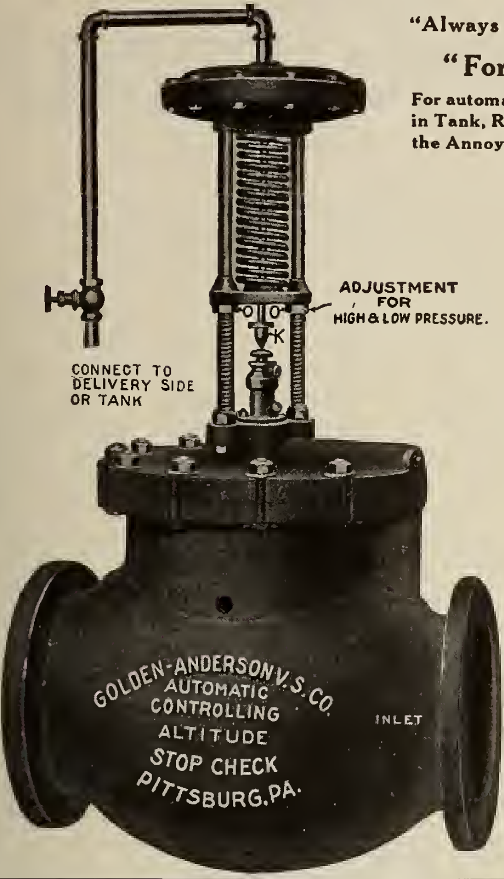
VALVES
and HYDRANTS
exclusive output.

The Golden-Anderson Pat. Cushioned Controlling Altitude Valves

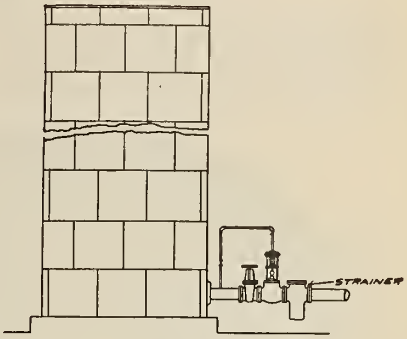
"Always Cushioned in Opening and Closing"

"For High and Low Pressure"

For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.



Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.



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Golden-Anderson Float Valves

GOLDEN-ANDERSON V.S. CO.
FLOAT VALVE
PITTSBURG, PA.

(Angle or Straight Way), up to 24"

Golden-Anderson Valve Specialty Co., 1247 Fulton Bldg. Pittsburgh, Pa.

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High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

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MEDUSA WATERPROOFING

for many important contracts in Canada.

It is a dry, white powder, the most convenient form, not only for shipment, but also for storage and use. Being ground extremely fine, it is easily mixed with cement in the exact proportions specified.

It gives absolutely permanent results, being insoluble and not affected by water even after years of contact. Its dry powdered form, and other qualities, make it the only true preventive of dampness in concrete, as cement users will learn by trial.

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Less is required. One part of Medusa will give permanent water resisting effect, while four parts of most others would produce merely a temporary result. This fact has been proved many times, and may easily be tested again.

Stinson-Reeb Builders' Supply Co., Limited

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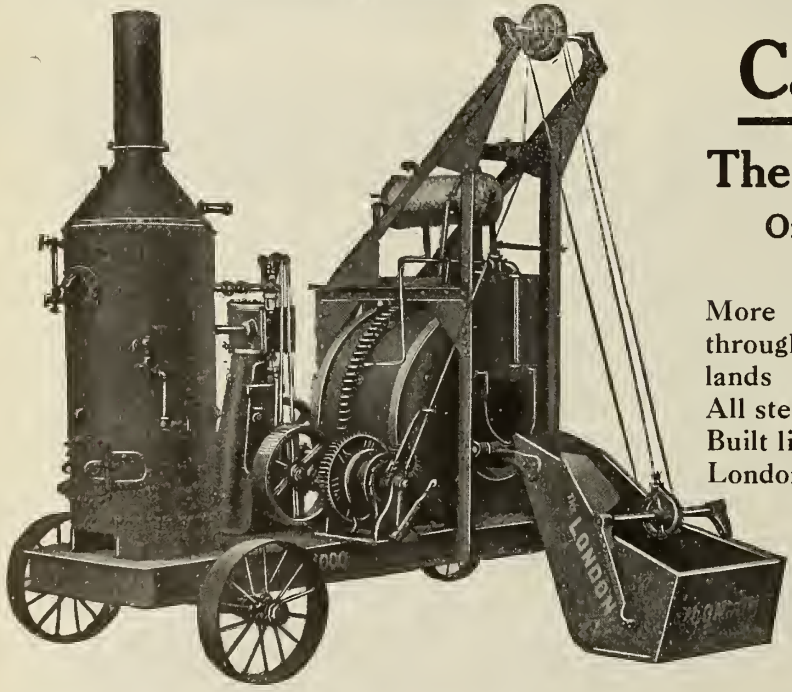

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Once a specialty—now a question of our output capacity

More than 1200 London mixers are in use throughout Canada to-day—also many in foreign lands The mixer itself supplies the reason. All steel construction with few working parts. Built like a battleship in its points of resistance. London Concrete mixers are made in twenty-three different sizes with any equipment.

Our manufactures comprise a complete line of concrete machinery and cement working tools.

We are the Largest Manufacturers of Concrete Machinery in Canada

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and Engineering Review

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Optimism Still Possible — Convincing Evidence of Building Returns

To those of our pessimistic friends in the constructional world who are casting about for a stray straw to keep them from being utterly submerged in the dark, chilling depths of pessimism, we would point the record of building permits for the seven months of 1914 ending July 31. In a comparison with the 1913 returns we find that thirty-nine cities of the Dominion rolled up a total of rather more than eighty-five million dollars last year in the seven months period, as against $71,000,000 this year. This means a decline of 16½ per cent.—surely a very satisfactory showing, all things considered.

Going into detail, we find that twenty-four Eastern cities expended, roughly, $44,000,000 from January 1 to July 31, 1914, as compared with rather more than $46,000,000 for the corresponding period of the previous year; while fifteen Western cities spent $27,000,000 this year as against $39,000,000 last year.

It will be seen that in spite of the great activity which prevailed last year throughout the Dominion, Eastern Canada at any rate practically held its own until the end of July, and even in the West the falling-off was not nearly so great as many would have us believe. It is noteworthy that the 1914 returns from Montreal and Toronto are neck-and-neck with last year's figures. In the seven months period of both years the Montreal total was in excess of eleven million dollars and the 1913 figures were less than $500,000 greater than those of 1914. The Toronto returns of nearly sixteen millions in 1914 as compared with seventeen and one-half millions last year are also very satisfactory. And Montreal and Toronto are not isolated examples. Other Eastern cities to record gains in the seven months period this year were Sydney, N.S., Maisonneuve, Quebec, Berlin, Guelph, London, Peterborough, Port Arthur, St. Thomas and Windsor.

In the West, the most conspicuous example of progress in the face of depression is Winnipeg, whose total of nearly thirteen millions in the seven months period of 1914 was nearly two million dollars ahead of last year.

The reader may object that we are talking of things that happened before the war broke out. Possibly he may challenge us, forthwith, to find some ground for optimism out of the present situation, leaving the records of the past to take care of themselves. In that event we take up the gauntlet and throw it down on the next page. There are grounds for optimism whichever way we turn. There is encouragement in the past, present and future. Canada's constructional achievements of the past should lead us to be optimistic in the present and imbue us with confidence in the future.

Pessimists, like the poor, we shall always have with us. So far, however—thank God—their dire prophecies have come short of fulfilment.

The British Nation

The nation is calm, collected, and determined. Mobilization is progressing swiftly and smoothly. Our transport both by rail and road is working splendidly. It remains now to keep calm, to trust in our authorities, Naval, Military, and Civil, and each on our own part to add the great or little help as it may be in our power to give to those around us.—The Engineer (London, Eng.).

The European War in Its Relation to Canadian Trade

A Time When Courage and Confidence Await the Dawn of Greater Opportunity—Every Incentive to Maintain the Country's Business Stability and Prepare the Way for Expansion—Exports and Imports

NOW that everyone has had the opportunity to express an opinion as to the probable duration of the war, the cost of it in men and money, its effect upon trade, and a dozen minor phases, there would appear to be some justification in taking a little time to sift the material—to separate fact from fiction, and to strike a midway course between the optimism offering on the one hand and the excessive pessimism prevalent on the other.

We are concerned with a brief consideration of the status and prospects of the trade of this country in relation to the struggle in Europe, but as an aside it may be observed that any close speculation as to the duration of the war is foolish at the present juncture. Precedent does not help us, the conflict being of an entirely new order: all that we can reasonably surmise is that the very magnitude of the operations to which the German Empire has committed itself will prove its undoing in a matter of months, however thorough its preparations may have been. At the time of writing, the allied forces of France and Great Britain are now in line preparing to check the enemy's encroachments, and, with the Russian army looming up large on the horizon, and British mastery of the sea already asserting itself in the re-opening of trade routes, we can only wait—firm in the conviction that the potent forces of might and right arrayed against the German war fiend must prevail.

Confidence the Keynote

In taking stock of present conditions, it is gratifying to find that loyalty and confidence are the keynotes of the situation. One may point to projects postponed, to establishments closed, to reductions of staffs and salaries, and so on; but, after all, these are not a fair gauge of the people's attitude. Nine out of ten employers are firmly persuaded that Canada's prospects are as sound as ever, and they are prepared to make a temporary sacrifice with a view to sharing in the greater harvest that will be reaped after the war. In this attitude there is the truest patriotism. It is not given to every man to fight, but to every man who cannot fight is given the opportunity to do his share in maintaining the productive power and business stability of his country.

By such eminent economists as Sir George Paish the view is taken that the present war will open up a tremendous opportunity for Canada and the United States. It is held that if the tide is taken at the flood it will mean not diminished but greater prosperity for us. Financial embarrassment must be experienced for a time, but this is an evil which will be common to the whole world. With the maintenance of ocean traffic and the opportunity to dispose of our farm products, the speediest recovery will surely come to Canada. New lines of activity will compensate in part at least for the depression in others. Far removed from the scene of hostilities, the internal trade of this country should suffer as little as any in the world.

Canada's Trade Mainly Within the Empire and with the United States

An examination of actual facts and figures cannot but be reassuring to the manufacturing interests of Canada. We find that in the fiscal year ending March 31 last our exports and imports represented a total value of more than a billion dollars—the greatest figures in the country's history. In this period a great stride was made in our exports, which amounted to nearly $432,000,000. The amount of trade done with the present enemies of the Empire was inconsiderable: our exports to Germany and Austria-Hungary combined amounted to less than four and one-half million dollars, while our imports from these countries were nearly four times as great. It is questionable whether it would not be in Canada's favor if the exchange of business were wiped out. Naturally the war will affect seriously the buying power of other European countries, but it must be remembered that our business with Europe constitutes only a small part of our external trade and that it is the other countries of the British Empire and the United States that are our best customers. Canadian exports to Continental Europe last year amounted to less than twenty million dollars, while our commerce with other parts of the Empire consisted of exports to the value of some $239,000,000, and imports amounted to $154,000,000—a total of $393,000,000. With the United States our trade consisted of exports amounting to $200,000,000 and imports valued at $411,000,000, a total of $611,000,000. Thus our trade with other parts of the British Empire and with the United States amounts to upwards of a billion dollars. With these things in mind and the knowledge that Germany's merchant vessels are being driven off the sea, one may surely conclude that ultimately the war will have a good effect upon British (including Canadian) and United States trade. Depend upon it that much of the German competition which British and American manufacturers have had to cope with in the past will be wiped out and that Canada will share in the transfer of the trade which Germany will undoubtedly lose.

In a sane, well-balanced consideration of conditions and prospects, we must not overlook the fact that one of the most certain results of the war will be a world-wide scarcity of capital for investment purposes. It is impossible to foresee in detail the far-reaching results of the changes that are taking place in the value of capital, but a natural outcome is that the carrying out of constructional works and public improvements will be considerably hampered. The activity will be all the greater when constructive enterprise finds its level. All the more vital is it for us to hold our ground.

The Ebb and Flow of Prosperity

Prior to the outbreak of hostilities, we had entered upon a period of depression. The explanation of this depression is not hard to find in economic theory. The value of all products is dependent upon the demand: while manufacturing facilities and outputs had been increasing by leaps and bounds there had been a number of extremely grave developments tending to diminish the demand. The greatest development of all, unforeseen though it was, was the preparation that was being made for the present war.

As a matter of fact, history shows us that trade depressions travel in cycles. Ever since England became a manufacturing country she has encountered an almost constant ebb and flow of activity in trade. Even in periods when there have been no outstanding disturbances like the present one, the cyclical movement has been definitely marked. It has been observed that from 1887 to 1896 the cycle ran in the order of revival, marked revival, prosperity, decline, depression, and slow revival; and from 1897 to 1906—prosperity, great prosperity, culmination of prosperity, slow ebb, depression, distress, revival, prosperity. History establishes clearly that the cyclical movement is part and parcel of the normal system of industry.

Encouragement from the Past

After the Napoleonic wars one hundred years ago, it was not long before England was on a quick run to prosperity. Marked improvement took place in almost every branch of domestic industry; funds rose, revenue increased, manufactured lines were in great demand, money was abundant, sales of land improved, gold re-appeared, and depression gave place to hopefulness and enterprise. We can glean encouragement from the leaves which record the experiences of other days.

It is only to be hoped that that great majority of us whose faith in Canada's destiny is unalterable will rise to the present emergency by united effort and preserve the internal stability of the country. There is ample reason to hope that, even with a continuation of the war for some time, there will arise new demands for industry to offset those that are cut off. From now on the factories of Germany, France and England, depleted as they will be by the call to arms, will scarcely be able to meet the demands of home consumption. Here, then, will be the opportunity for Canada and the United States. Markets will arise in other parts of the British Empire, and these will be strengthened by a feeling of greater reliance in Canadian and United States products. "It is an ill wind that blows nobody good": possibly one of the most marked benefits that will arise out of this terrible conflict will be the stimulus afforded the manufacturing industries of the North American continent. The cessation of imports from continental Europe into Canada will give many home industries an unexampled opportunity for immediate development on an enterprising scale. Canada has a home demand which must be satisfied, and, with the untold natural resources of the country, we can look with confidence to the supply from within. Much of the new trade will be held, and so Canada will prosper at the expense of the belligerent countries.

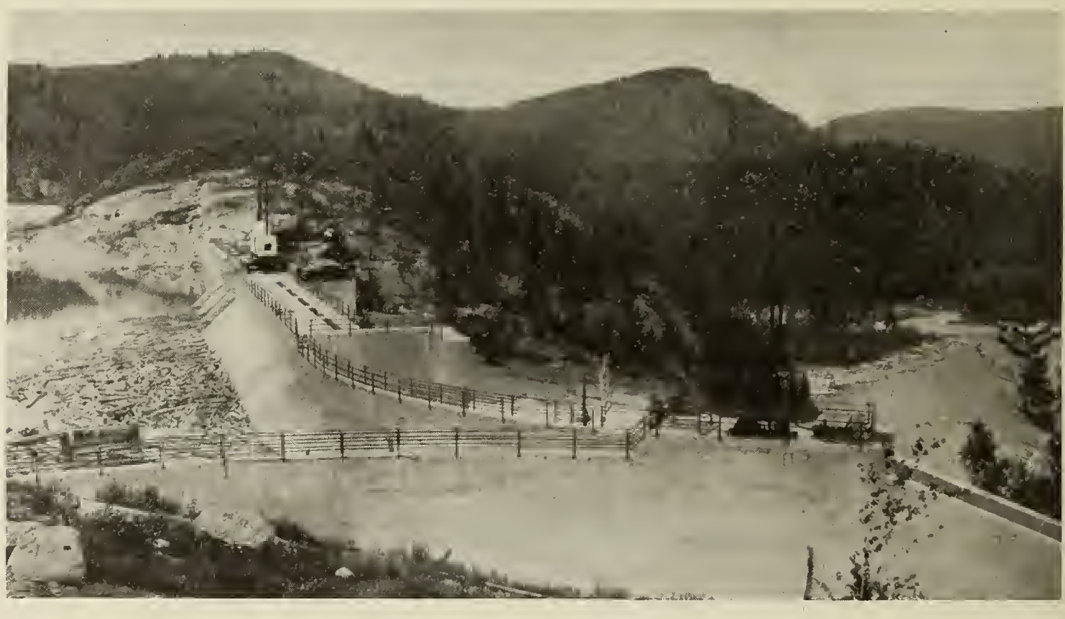
We are persuaded that the greatest desideratum of the moment is confidence. It was the supreme confidence which Drake had in his fleet which enabled him to finish a game of bowls before he engaged the Spanish Armada—and the odds which Drake faced, with the Spanish fleet in the offing, were surely as great, in proportion, as the Empire is concerned with to-day. If, as time goes on, Britishers show themselves possessed of that calm self-control which is so essential to success on land or by sea, in peace or war, their destiny will not be shaken by the outbreaks of a dozen crazy fanatics like the Emperor William. We of Canada to-day share with the rest of the Empire the responsibility of showing that confidence which will not only inspire courage in recruits for the front, but produce men of calm judgment at home to maintain our reputation as a well-balanced business community. We have the ships, we have the men, and we have the money. There is no need for us to be apprehensive of the present conflict. Let us look to business and avoid panic.

It has been recognized for some time that the results obtained by the sand blast in the testing of clay products are as indicative of value as the more usual tests. The main objections to this method hitherto have been the difficulty of standardizing and the cost of the apparatus. By using centrifugal force in place of compressed air a machine can be built which is free from these objections. Tests on brick and plate glass, using the new machine, show that results are comparable, more easily obtained and reproduced, and, if anything, more reliable than the combined tests, particularly in respect of the grading of manufacturers and users. Results so far obtained indicate that sands of widely differing origin may be used and that further experimentation will produce factors which will permit the adoption of this machine as a standard instrument.

A Reinforced Concrete Log Chute and Dam at High Falls, Quebec

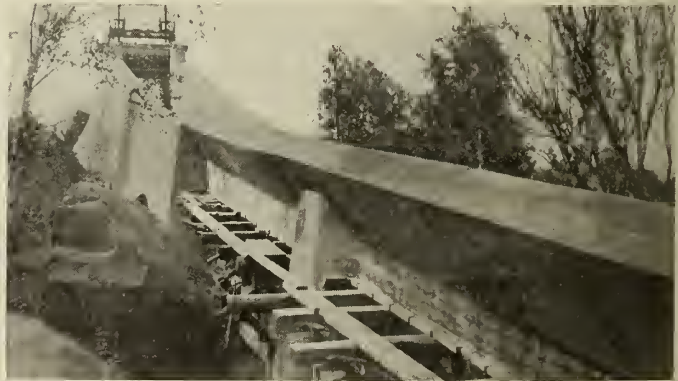
THERE has recently been put into successful operation by the Jas. McLaren Lumber Company, Limited, of Buckingham, Que., a reinforced concrete log chute, the only one of its kind in Canada—and perhaps in the world. The structure is at High Falls, on the Lievre River, in Quebec, and it is reported to have been in satisfactory operation for several months. From the standpoint of efficiency in delivering the logs, it is said to have recorded a great advance over the old timber chute which it replaced. The Lievre River is a stream of good volume and drains an area of 4,000 square miles. At the approach to High Falls it flows over a bed of granite and the sudden drop at that point is about 160 feet. At the head of the Falls the stream is naturally divided into two channels by a rocky island. The smaller of the two is the north channel and in nature the main or south current discharged itself over a rocky precipice in a white foaming mass. The safe delivery of logs over such a place was impossible, so for years they had been carried down in an old rectangular-bottomed timber-built chute. In 1910 the lower section of this structure went out, after doing duty for many years. In planning a replacement it was thought that the fact that the MacLaren limits could be made perpetual justified a permanent structure. The Company then decided upon a concrete chute to replace the old one and the discussion of the details concerning it revived a long-cherished desire to so improve the advantages of the splendid water power that it might be utilized so soon as a profitable opportunity presented itself. So in making the designs for the new chute it was incorporated as part of a large and excellent scheme of conservation and development.

The scheme included two dams. The more important was across the main or south current. In it were the log chute outlet, the flood gates and provision for five power flumes each capable of furnishing water for a 10,000 h.p. unit. The north dam was designed as a regulating dam and was so constructed as to provide



Dam and log chute at High Falls.

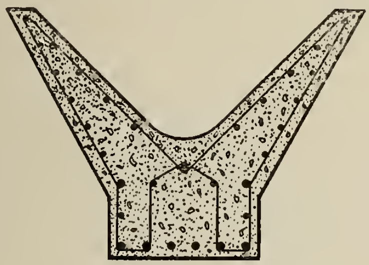
North dam at High Falls on the Lievre River, showing outlets for flood water overflow.



Upper section of concrete log chute.

escape for the discharge in the case of exceptional high water. The log chute was placed to the south of the whole structure.

In 1910-1911 the lower section of the new concrete chute was built and connected with the old section above. As the workable structure thus stood, it comprised 375 feet of concrete and 1,500 feet of timber. Economy in the use of water had to be a guiding principle, as the more water went over the slide the less there would be for power. The V-shape was therefore adopted for the chute, as it was considered by far the most saving and adaptable. The design of the chute took into consideration the natural narrowing of the current in the gathering speed of the descent and the height of the sides were gradually decreased towards the foot. The maximum slope of the chute was fixed at 1 in 4, except at the lower end. There, about forty feet from the mouth, the gradient was sharply lessened and changed from a straight line to the arc of a circle of 225 feet radius. The change of grade being near the point of discharge, the retarding of the speed was so small as to be negligible and the result as designed was to throw up the lower end of the log and cause the drop to be made horizontally to the water. The upper end of the concrete chute was finished in July, 1912, and used for the discharge of the logs that year, but it was not until the completion of the whole work that the full efficiency was realized. This year the working of the permanent structure has more than justified the expectations of the engineer and the company. The new structure uses less water, discharges more logs and requires fewer men. The old slide required from fourteen to sixteen men to operate it and it discharged from 12,000 to 15,000 logs in ten hours. The new slide can be worked by six men and will discharge 50,000 logs every ten hours. The velocity of the logs in the 1 in 4 grade has been calculated to be 55½ feet per second. The total length of the slide over all is 635 feet. Its pier supports number eight. The admission gate for the logs consist of pine stop-logs bolted together. They are ten feet long, twelve inches thick and twenty-four inches deep, and are lifted and lowered by a hand winch.



Typical section of log chute.

Everything about the structure is of the most permanent nature. When the foundation trenches were blasted for the dam a ledge of the country-rock (grey granite) was left and against this the footing of the dam abuts. The dam has three regulating sluices. The piers between them are approximately in the shape of a long ellipse. The stop-logs for the regulating sluices are of Douglas fir and are twenty-two feet long, thirty-six inches deep, and vary from fourteen to twenty-two inches in thickness. The stop-log winch for handling them is operated by a two-cylinder steam engine which was built by the Victoria Foundry Company, of Ottawa.

The five entrances to the power fore-bay are submerged sluices covered by a reinforced concrete apron to prevent logs from being drawn in. The apron turns the logs to the slide and is carried sufficiently low to be below the point of lowest water. The draught to the power sluices cannot therefore affect the logs and the dam is so constructed that they are brought to the slide at all levels of the water.

The plans for the full structure were made in 1911 and the contract was let to Messrs. Haney, Quinlan & Robertson for the construction of the new dam and the completion of the log slide. Pouring concrete was started in the spring of 1912. In the whole work there are 100 tons of steel and 21,400 cubic yards of concrete. The total cost of the structure was $250,000.

The work here described is but one of several important power development structures that have been designed by Mr. J. B. McRae, of Ottawa, the engineer for the work. One of them is the dam and power-house at Ragged Rapids on the Severn River, which were built for the town of Orillia. Mr. McRae designed the dam and power-house (now building) for the Electric Reduction Company, at Buckingham, Que. He was also associated with William Kennedy, Jr., in the design and construction of the splendid dam at the Chaudiere Falls on the Ottawa River, which was undertaken for the large group of power owners of the cities of Ottawa and Hull.

Bonding Asphalt to Concrete

Among the several problems to be met in the recent construction of the concrete reservoirs in San Francisco was that of bonding asphalt to concrete. According to B. N. Abbott, in a letter to Engineering Record, after making unsuccessful attempts to apply the asphalt direct to the concrete in various ways, the expedient of first painting the surface with coal tar was tried, and it was found that when applied in this way under right conditions the asphalt would adhere so firmly that after it had cooled it could not be broken away without bringing pieces of concrete with it. Mr. Abbott states that in order to secure this result the concrete surface was first scrubbed clean with a bristle brush, and over this a thin coating of hot coal tar was "painted." The coal tar should be heated in small quantities, brought just to the boiling point and then applied immediately. Heating the coal tar in large quantities, which necessitated some delay before it could all be used, did not give such good results, and the gangs were therefore not allowed to heat more at a time than they could apply quickly as soon as it began to boil. The asphalt was spread over the tarred surface in the usual manner.

In Turkey, where cement is not used or is hardly known, a substitute has been found that has met with rather good results, when applied in exposed places, in filling crevices in water pipes, covering joints in stone floors, in fountains, and for numerous other purposes where cement would be required. It is stated to be as satisfactory in water as in exposed places, but it must be allowed to become thoroughly dry before it is submerged. The mixture is slaked lime, linseed oil, and cotton fibre. Generally a hollowed-out stone is used, although a flat, hard surface will answer, and the process is started by pouring the oil on a handful of cotton, after which the lime is dusted in. It is then kneaded until the whole is thoroughly mixed and about the consistency of dough. The more it is kneaded the better it becomes.

Efficiency and Economy in the Design of Factory Buildings*

By W. E. King

THE economical design of factories involves the solution of a large number of simple engineering problems. It is the intention of this paper to discuss these problems in their relation to each other in order to give a general view of the economics of this form of construction.

Factory design requires a broader knowledge of engineering than for most types of buildings. For this reason it is the work of an industrial engineer rather than an architect.

The industrial engineer should be an engineer with a fair working knowledge of architecture, civil, structural, mechanical and electrical engineering. It is essential to the economical design of any building that is to house machinery and human beings doing work which involves repetition of the same act that the designer of that building should have a very clear working knowledge of all the machinery installed and the processes which are to be carried on in the finished structure.

In organizations which do a considerable industrial engineering business it is customary to maintain engineers familiar with the various manufacturing processes. Such an organization usually maintains mechanical, electrical, civil engineering and architectural departments.

A purely engineering organization will tend to minimize the importance of the architectural requirements of the work devoting its time to the considerations of economy of construction and efficiency of operation. Both phases of the question should be considered in the design of any building, but certainly the aesthetic considerations in the design of a factory are not as important as the parts of which the study must necessarily be made by an engineer.

Whatever may be the title by which the designer of such a building be called, it is at least fair to state that all parts of the structure should actually be designed in his office and such work be paid for by him as a part of the service for which his clients pay him. The practice of some persons in the business of forcing the contractor for structural steel, or reinforced concrete, or other parts of the building to prepare the designs is certainly unfair to the client. There are other disadvantages in allowing the contractor to do the engineering.

Location

The work of the industrial engineer should commence, if possible, before the location of the factory is determined upon. The first consideration is, of course, the proper locality for the industry. This is largely an economic problem which the engineer may or may not be required to study.

The cost of any manufactured commodity to the retailer consists of the following items: Cost of raw materials, cost of the transportation of these raw materials to the factory, cost of labor on materials, cost of power, overhead charges, including interest on money invested, depreciation of plant, insurance, office time and advertising, cost of distribution and profit to the manufacturer.

Assuming the price to be received for any finished commodity to be fixed by competition, then that project which will pay the largest profits is, of course, the one where the sum of the first six charges is a minimum. This does not necessarily mean that any one item should be reduced to a minimum, but that the sum of all the items taken together is the least possible. The usual difficulty is that some one man almost always plans each project with the idea of reducing some one item to a minimum. For instance, a man who had spent the larger part of his time in handling of workmen will insist that the plant be so located that there will be an abundance of cheap labor. If he had at one time been a purchasing agent he would plan his plant to save all freight possible on raw materials. The sales manager is interested in the location of the factory with respect to the market. The man who furnishes the money is sometimes unduly interested in cutting the first cost down to a minimum, without regard to whether the interest on his money might be larger if more money were invested.

It should be the duty of the engineer to study these questions and to present them so that they will occupy their proper rank of importance. This rank is, of course, different in different kinds of factories. In the fabrication of structural steel, for instance, perhaps the most important factor is freight. This includes freight from the rolling mill to the factory and freight on the finished product from the factory to the consumer. In some parts of the United States this freight amounts to more than half the cost of the finished product. However, in the manufacture of candy, for instance, the freight is of small importance and the proximity to the market and the cost of labor is of greater importance.

Use of Charts

Where freight is one of the chief considerations, charts may be prepared showing the zone in which a product may be profitably marketed. The boundary of each zone will be determined by considering the sum of the freights on raw and finished materials for the proposed location as compared with other possible locations. The properly prepared chart will show the overlapping territories where competing factories sell on an equal basis. It will show the area where the factory in question has the advantage and it will also indicate the areas which cannot profitably be reached.

The matter of available market probably reaches its greatest importance when the capacity of a profitable factory is about to be increased. It may be that the selling organization is now reaching all of the profitable market zone and that to increase the sales the product must be marketed at a disadvantage.

Some industries use large amounts of fuel or power which requirement is the determining factor in their location. Many of our rolling mills are located at Pittsburgh because of available coal supply. The cheap water power at St. Anthony Falls partly determined the location of our flour milling industry. This tendency to group factories around water power sites will probably not be as marked in the future because our modern methods of electrical transmission allow power to be delivered economically at a considerable distance.

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*From a paper delivered before the Civil Engineers' Society of St. Paul.

Having determined on the vicinity where the factory is to be built the next consideration is the purchase of the exact site necessary for the project. The exact area of land which is necessary is usually a troublesome one. Most successful projects are hampered by lack of room to provide for their growing needs. On the other hand, it is a serious handicap to a young industry to be burdened with heavy interest charges and taxes on land not at the time in use.

The size and shape of the area necessary for present needs is usually determined by making a preliminary plan of the whole project. If the engineer is unfamiliar with the need of the industry in question, this will usually involve quite an extended study of the methods of manufacture used by the particular organization and of similar organizations in other places. If, however, the designer has already prepared plans for other similar plants the tentative preliminary plans involve only a study of the peculiar requirements of the special case. This preliminary plan should take in the reasonable growth of the industry, which usually may be approximately obtained by a comparison with similar industries in other communities. With the approximate area required clearly in mind a search of the locality will usually show a number of available sites. For projects of some importance plans are usually prepared showing how the proposed sites may be developed. These plans should show the approximate grades and elevations of all adjacent streets, the location of sewer, gas, water and power connections and the available connection to adjacent railroads or sidetracks. If grading of streets or of the lots will be necessary this should be estimated and added to the comparative price of the lots. For the purpose of comparison the cost of the sidetrack, including necessary grading, the cost of sewer, water, gas and power connections should be obtained. Very often the owners will buy a lot first, without considering the cost of those items which must be added to make the lot available, and in so doing they fail to get the most economical site. Plans showing the proposed sidetrack should be submitted to the railways interested and assurance should be had from their engineering and contracting departments that they are willing to put in the desired connection. If the side track must cross the public road it is well to be sure of the permit before putting money into the lot.

Side Tracks

At this time a study should be made to determine the number and length of side tracks which will be required. In general the track should be long enough to hold as many 40-ft. cars as the company will need to load and unload in any one day. In isolated places where the cars are not set as often as that, the side track must be long enough to allow for all the unloading and loading which must be done between each setting by the switch engine. Side tracks for loading and unloading should in general be level. The rules of the railroad in question, of the state and interstate railway commissions, and the state labor laws are the determining factors in the amount of room required for side tracks.

Building Plans

After the exact location of the site is determined then the plans of the buildings may be prepared. It is, of course, a mistake to make the final plans of any building before its definite location is settled. The natural grades of the land itself, the streets, the points of the compass, and the condition of the sub-soil almost invariably change the plans to such an extent that they must be revised or re-drawn. All of these conditions should be determined by an exact survey before work on the plans commences.

As before stated, the basis for the design of the factory building should be a complete understanding of the processes to be carried on in the building. Too many factories are built first and the machinery just put in, one piece at a time, after the building is completed. This usually results in the uneconomical use of the floor space; unusual spaces occur in some parts and a congested condition results in other parts.

The first plans to be prepared should be complete machinery plans. A study should be made of the progress of the materials through the shop. In general the manufacturing process should be so arranged that there will be no lost motion. The various materials which go to make the finished product should all travel through the various parts of the factory in such a way that they will arrive at the assembling room without having been transferred more times than is absolutely necessary. After leaving the assembling room the materials should go by the shortest possible route to the storage and shipping rooms. This part of the work is best planned with the prospective superintendent of the shop. It is sometimes difficult to get the benefit of this man's detailed knowledge and experience without letting his narrowness of viewpoint blind the designer to the broader phase of the question.

As a rule a good factory superintendent has spent the larger part of his life in some one factory. He probably has made that factory a success. That leads him to think that he knows all there is to know about that business. At least he thinks he knows more than any engineer whom the owners can hire. That is generally true, but his difficulty is that he is so close to his job that his perspective is warped. For instance, if ten years ago he tried a belt conveyor in his factory which he bought and installed improperly himself, and then afterward abandoned because it did not do the work required, he is convinced that he does not want a belt conveyor in his new factory. The fact that belt conveyors have been improved since he tried them and that there are thousands of them working satisfactorily under similar conditions, will impress him only if you can overcome his prejudices. If you can make him feel that he and the engineer are working together to get the best possible design and that you realize the value of his suggestions, then, generally, it is possible to get him to listen to yours.

It is a common thing to have one of these so-called "practical men" say: "You build me a building so big and I will put the machinery in myself, without any plans." Even with a man competent to do this, there is considerable advantage in arranging the machinery on paper first. It is easier to see where the waste spaces in the room occur and to correct them on paper than it is with the full-sized building. Then, too, these machines usually have foundations, shafts, electric wiring, and these things have a tendency to interfere with each other and to require the cutting of unsightly holes in the completed building.

The building should be built to suit the machinery. The columns and beams, the height of storeys, the location of heating and plumbing pipes, the sprinkler system, and the natural and artificial lighting should all be aranged to suit the machinery.

The economical arrangement of the structural parts of the building should also be taken into consideration in the arrangement of the machinery. If possible the columns should not be spaced to suit special machines unless there is some very decided advantage in doing so. It must be remembered that the life of a building is several times the life of the machinery installed and that the machinery of the future may be entirely different.

Types of Factory Buildings

There are two types of factory buildings which are here considered separately. The first is the ordinary one-storey building with a hip roof which may or may not be surmounted by a monitor. It usually has large unobstructed floor space to provide for the movement of cranes and other large machinery. The second type is the warehouse type of one or more storeys in height. Industries which require a clear floor space of more than 25 ft. in either direction are usually housed in one-storey buildings, because it is expensive to carry the weight of upper floors on long spans. Where the materials manufactured are of such size that columns spaced from 16 to 25 ft. on centers are not objectionable the building of several storeys is usually more economical.

A one-storey building costs the most per square foot of floor area. This cost per square foot decreases somewhat with the number of floors built, up to four storeys. Above that height the cost per square foot gradually increases. There is comparatively little difference in the cost per square foot of floor area between a three-storey and an eight-storey building.

If basement floor space is suitable it is the cheapest which can be obtained, except where the loads to be carried on the first floor are extremely heavy. A one-storey shop building in fireproof construction will cost from $1.25 to $2 per square foot of floor area, depending upon the height of the storey, depth of footings, lengths of spans and kind of exterior finish used. Fireproof buildings of more than one storey may be built for as little as 50 cents per square foot of floor area. These approximate figures do not contemplate any sort of plaster or interior finish except whitewash. They do include a properly finished cement floor. The cost per square foot of course decreases as the size of the ground plan increases. It is more for a long, narrow building than for a square building. However, a factory building should not be made too wide on account of the difficulty in properly lighting the interior. For ordinary factory work from 40 to 50 feet is the best width. A building of this width can be lighted with a storey height of from 12 to 14 feet. If the width of the building be made from 75 to 100 ft. then the storey height should be increased to from 14 to 16 feet, the windows being placed as high as possible.

One-storey shop buildings are usually built of what may be termed semi-fireproof construction. They are usually built of materials which will not burn but cannot be said to be entirely fireproof because the steel trusees are usually left unprotected, so that they might be damaged in case of fire occurring in the contents of the building. As before stated, the one-storey plan is usually adopted where large, unobstructed floor spaces are required. This results in long-span steel trusses supporting the roof.

The most common type of roof is the "A" shaped roof. This roof has many advantages. It is easy to keep water tight, it clears itself of snow easily, and with monitors or ventilators at the peak it provides good ventilation for the factory. If these monitors are made wide enough and are provided with windows they admit considerable light, but if the building is high and wide, monitor windows usually do not admit a satisfactory light.

A better type of roof, where light is essential, is the saw-tooth roof. This roof is made up of a series of pitched roofs, rising towards the north and stepping down with a vertical step, in which windows are installed. These windows, facing towards the north, admit a diffused light which illuminates the floor below without casting shadows. If the windows in the saw-tooth construction are arranged to swing, they provide as good ventilation as the old monitor type. The disadvantage with saw-tooth construction is that it presents a number of valleys where snow may lodge. In some cases steam pipes have been installed to melt the snow. This serves the purpose, but it is rather expensive. In buildings where there is considerable steam in the air condensation gutters are necessary under monitor and saw-tooth windows.

The Roof

The most unsatisfactory problem in shop building is probably the roof. It first must be watertight; second, if the building is to be heated in winter it must be of such material that condensation will not occur on the underside; third, it should be fireproof; fourth, it must compete with a large number of cheap roofs which are lacking in one or all of these qualifications. A standard roof construction consists of 3-in. hollow book tiles laid on steel T-beams. These tiles are covered with some good prepared roofing which is cemented and tacked to the tiles. This roof is very expensive, but it fulfills all the requirements stated above. It costs, including supports, about 30 cents per square foot.

Another good roof consists of 2-in. dressed and matched sheathing, laid on wood or steel purlins and covered with a good prepared roofing. It is practically as good and much cheaper than a book-tile roof, but, of course, is not fireproof. It will cost about 20 cents per square foot, including supports.

In some cases a thin concrete slab laid on steel or concrete purlins has been used. Considerable condensation occurs under such a roof in cold weather. Furthermore, it is very difficult to keep a thin roof slab from being damaged by frost while being laid in cold weather.

If the shop is not to be heated in winter corrugated iron laid on steel purlins makes a very inexpensive fireproof roof, costing about 12 cents per square foot in place, including supports. It is fairly water tight but, of course, is very cold in winter.

There are, of course, many other kinds of roofs, but the price of any roof comes between the limits here given.

There is not so much choice in the materials for constructing the side walls of a building as the roof, although they may be of brick, stone, concrete, corrugated iron or glass. Buildings with high storeys are usually made with steel frames, the walls being simply curtain walls, bricked in between the columns. Hollow brick should be used for the inside layer to prevent condensation of the side walls.

Concrete for side walls is often more expensive and is less satisfactory than brick. Concrete blocks are sometimes used and are satisfactory where enough cement is put in the blocks. Such walls are, however, weak, due to the lack of bonding between the blocks.

A 12-in. common brick wall in this part of the country will cost about 38 cents per square foot in place. With a good facing brick and some architectural decoration the cost may be increased to from 40 to 60 cents per square foot.

In the modern factory building the selection of the material for the outside walls is not such an important feature because from 75 to 100 per cent. of the wall area is occupied with windows and doors. The old style shop building did not, as a rule, admit enough light. Some of our new buildings probably admit too much. It is a mistake to assume that a workman needs as much light to work by as there is out under the open sky. Too much light is almost as bad for the eyes as too little. Most of the inconvenience of working indoors comes from working with a strong light from one side which casts shadows. Windows should be so arranged that light will reach every point from at least two directions and be of as near the same intensity in both directions as possible.

Another question upon which there is usually some argument is the kind of windows to be used. The three types most used are the standard wooden sash, the rolled steel sash and the fire undrewriters' sash of sheet steel or copper. The underwriters' sash is very little used for shop buildings because of its high cost. It will, however, greatly reduce the insurance rate upon such walls of the building as have a bad fire exposure. Underwriters' sash cost about $1 per square foot, glazed with ¼-in. wire glass and set in place.

The most satisfactory sash at the present time for factory work is the rolled steel sash. Where large areas are to be glazed the small size of the steel muntins and mullions permits the maximum amount of light to enter the building. Several factories have been built with the side walls almost entirely of glass, the only obstruction in the walls being the columns and the brickwork at the floor line. The cost of steel sash set in place and glazed with double-strength glass runs from 40 to 45 cents per square foot, depending upon conditions. A steel sash has a few disadvantages which should be taken into consideration. The ventilation is usually secured by pivoting a part of the sash near the middle. In factories where screens are necessary it is not possible to have ventilation because the screen will not permit the ventilator to swing. In northern climates a storm sash is desirable because of the loss of heat through the glass by conduction. A steel sash is too heavy and too expensive to use for storm sash. If wooden sash be used the advantages obtained by the use of steel inside sash are lost.

The cheapest sash to use is undoubtedly the double hung wooden sash with which we are all familiar. Its cost is from 25 to 50 cents per square foot, in place. It allows of 50 per cent. opening for ventilation. The details of window openings and their connections to the remainder of the building have been worked out through long use and can be made to fit any opening without additional cost. Where the window areas are large the wooden mullions and muntins must be made of considerable size for strength. This results in a considerable obstruction of light.

General Classes of Factory Buildings

Considering factory buildings of more than one storey, they naturally divide themselves into four general classes, according to the materials of which they are constructed. This classification is really made by the fire underwriters inasmuch as the different types take different insurance rates. In fact, the rate of insurance is the consideration which most often determines the type of construction.

These classes are: Frame construction; slow burning timber construction; structural steel; and reinforced concrete.

In the frame construction class should be included all buildings having either brick or timber walls, wherein the floors are of wood and the joists are narrow and closely spaced. Such buildings are, of course, the cheapest which can be built. By far the larger number of the present factory buildings are of this type. When an industry is in an experimental stage, and where the processes of manufacture and the machinery are likely to be changed with experience, it is more economical to build in this manner. If a building is anything more than a temporary structure the extreme fire hazard, the danger of employees upon the upper floors, and the lack of rigidity for supporting machinery are disadvantages which should be taken into consideration.

The insurance rate for frame constructed factories without sprinkler systems varies from $1.25 to $2.50 per year per $100 of insurance. The value of the contents of the building may equal that of the buildings, and the rate on the contents will usually not be less than on the building.

If the frame type is to be used the insurance rates may be reduced about 60 per cent. by the installation of the standard sprinkler equipment. This equipment will cost from 5 to 15 cents per square foot of floor area, depending upon conditions. That is, in a cheap building the cost of the sprinkler equipment will add to the cost of the building from 10 to 20 per cent., but this cost is usually paid for in the first few years by the decreased insurance rates.

There is another loss to be considered which cannot be covered by fire insurance, namely, the loss of profits due to the interruption of business. This includes not only the current profits but also the loss of customers. In a growing concern this loss is generally more serious than the damage done by the fire.

In the slow-burning mill building construction, as described by the fire underwriters, the walls must be of brick or stone. It differs from the frame construction in that the joists are spaced from 3 to 6 feet apart and are timbers of considerable size. The floors are matched planking. All stair and elevator hatchways must be enclosed, with doors at each floor opening. This construction is somewhat more expensive than the frame construction. Its principal advantage is that it takes an insurance rate about 20 per cent. less than frame construction. If a sprinkler system is installed this rate may be reduced to about 48 cents. The first cost of the building will be from 10 to 30 per cent. more than for frame construction, with brick walls.

Any timber construction has several advantages over more permanent types, such as concrete or steel. Alterations in the buildings, due to changes in processes of manufacture and to the installation of new machinery, are much more cheaply and rapidly made. The expenses of attaching shafting and machinery to the finished structure is considerably less. Wooden buildings are much more rapidly constructed than either reinforced concrete or structural steel buildings.

The columns in buildings with wood beams should be spaced from 12 to 18 ft. on centers. If a greater column spacing than this is required it is usually more economical to make the beams which span the longer direction of steel. These beams may rest on cast-iron or steel columns, the remainder of the construction being of wood.

A better construction consists of steel columns and beams throughout. The floors may then be made of reinforced concrete or tile. If the columns and beams are then covered with fireproof material such as tile or concrete the building may be regarded as the best type of building which modern civilization has produced. It is also the most expensive, costing from 5 to 20 per cent. more than a reinforced concrete building. In such a building the steel columns do not occupy so large a percentage of the floor area as do concrete columns. Exact stresses in a steel frame building are more easily computed. The chance for variation in the strength of the material due to faulty workmanship or design is not nearly so great. Alterations of the building are more economically made in a steel than in a concrete building. The insurance rate for such a building as compared with a frame building, taking a $1.50 rate, would be about 90 cents per $100 without sprinkler system. With a sprinkler system this rate would be reduced to something like 36 cents per $100. In fact, many buildings of this type take a rate of from 10 to 20 cents per $100.

The most popular type of factory building in the vicinity of St. Paul and Minneapolis is reinforced concrete. In this respect we are away in advance of other localities. In fact, we probably have a larger proportion of reinforced concrete factory buildings in the Twin Cities than any other locality in the United States. This is largely because there are a number of contracting engineers of unusual ability in this vicinity who are financially interested in the sale of the reinforcing steel entering into these buildings. Their influence is evident in the building ordinances of the Twin Cities, which allow higher unit stresses in both the concrete and the steel than are common in the cities of the east.

A properly designed concrete building is the best building which can be put up for many industries. It is entirely fireproof and takes the same rate of insurance as a fireproof steel building. Such buildings are probably the most rigid type which can be constructed. The material will stand a large amount of abuse in the way of faulty workmanship and design. Other types of buildings deteriorate with age, but a properly constructed concrete building increases in strength.

The floor spans of a concrete building may economically be made from 16 to 24 feet. The exact span for minimum cost depends upon the expense of the foundations. The more expensive the foundation piers the longer may be the economical span. We find that the flat plate type of column pier is considerably less expensive than the old-fashioned masonry piers of the pyramid type.

The statements made concerning the exterior walls of one-storey buildings are true in regard to buildings with a greater number of storeys. It is usually economical to build self-supporting, exterior walls for buildings up to three storeys in height. For buildings higher than three storeys the walls are often made 12 inches thick and are carried upon the steel or concrete frame of the building.

Water Sterilization by Ultra-Violet Rays

WITHIN the last five years a new field for the application of electricity has been created in Europe based upon the electrical production of ultra-violet light for the sterilization of water and for other purposes. As this new industry is now being introduced into this country, it is of interest at this time to analyze its basis and principles.

The only industrially-applied source of ultra-violet light is the mercury-vapor quartz lamp. The spectrum is known by its bright lines in the visible part and by a large number of typical lines in the ultra-violet part, as shown in Figure 1, which is drawn to proportional scale.

The most efficient way for the mercury lamp to react upon water seems to be to submerge the lamp entirely in the water which is to be sterilized. Direct contact, however, of the water with the heated lamp influences the luminous and ultra-violet efficiency of the quartz lamp to an enormous degree. It seems to be certain, therefore, that it is better, if one wants to plunge the light source into the water, to protect the lamp from direct contact with the water, and this system has been adopted with modern apparatus. This protection against direct contact can be secured by fusing over the lamp a wide quartz jacket which prevents contact of the light-giving portion of the lamp, with the water.

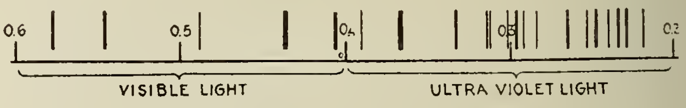


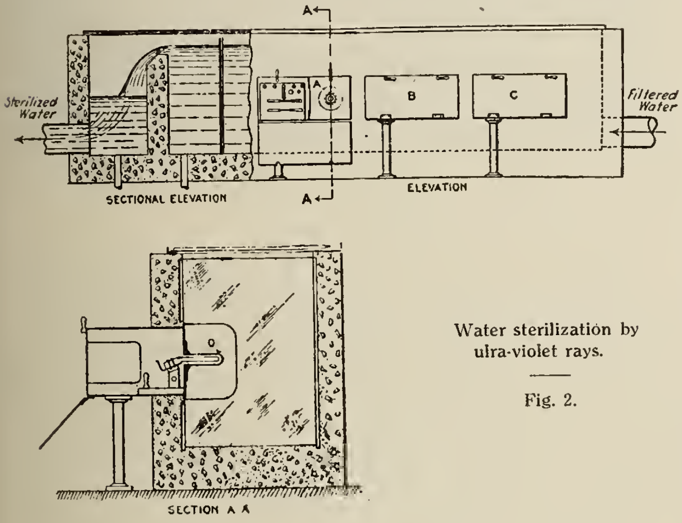
Fig. 1—Spectrum of mercury vapor quartz lamp.

Difficulties, however, arose in the manufacture of such jacketed lamps and it was found advisable to construct the apparatus in such a way that the lamp was removable from the protective jacket, as shown with the so-called pistol lamps, Figure 2, allowing, nevertheless, all the light to enter the water.

Different germs have different sensibilities to the ultra-violet rays. The ones of greatest interest to us are the water bacteria, and we find that they are killed in as short a time as 1/20 second, at a distance one to two centimeters from the powerful ultra-violet ray lamps. Water being practically as transparent as air to the ultra-violet rays, we are therefore certain that if a germ floats in the water it will be annihilated by getting into the illuminated zone, the condition for this being that no suspended matter is contained in the water which would form a shield for the germ.

Water for this sterilization has, therefore, in most cases to be filtered before being submitted to the sterilizing action of the rays. However, even very good filters will allow some microscopic matter to pass. It is much more effective, as shown by experiments, to stir up such water while it is going through the illuminated zone so as to turn over and over any particles which otherwise might allow microbes to pass by under cover. The baffle arrangements as shown in Figure 2 are built in for this purpose of stirring up the water. For the same reason, also, it is best to pass the water through several illuminated zones, which can easily be done by leading the water several times towards the same source of light, or by passing it successively under several sources of light, as shown in Figure 2.

The largest unit ever built was set up about two years ago in the city of Luneville, France, to sterilize the city water supply. It consists of a flume into the sides of which ten 500-volt pistol lamp equipments are inserted. These equipments consist of metal boxes for the starting of the lamps (the latest types of them contain also the rheostats). The boxes are equipped on the inside with a stuffing box arrangement holding the quartz protective tube which protrudes into the water. The lamps are lit in the starting boxes and then their luminous parts are inserted into the protective tubes, so that the light emitted from the lamp enters the water.



Water sterilization by ulra-violet rays.

Fig. 2.

The raw water fed into this plant comes from the Meurthe river and contains sometimes as high as 60,000 germs per cubic centimeter. It is clarified by a series of roughing filters and one filter. After this it is physically in fairly good condition, being very poor in suspended matter, but having from time to time fairly deep color (up to 45 U. S. standard) in solution. The germ contents are sometimes as high as 1,000 per cubic centimeter in this water. It is then passed through the sterilizing unit described above, coming under the influence of the light from one to two minutes altogether, according to the number of lamps running. This number (sometimes only 4) depends on the physical condition of the water, which is easily observed. The bacteriological tests of the water when leaving the sterilizer rarely show more than 10 germs per cubic centimeter and are often zero. Bacterium coli is always eliminated. Not only are the bacteriological tests satisfactory; the health of the community has improved considerably. Typhoid used to cause from 70 to 160 deaths annually; it is now practically eliminated, there being no cases at all this year.

Another typical installation was made in New York lately for the purification of the water of a swimming pool, which is naturally exposed to continuous pollution from the bathers. The water in this case is circulated continually through a filter to take out suspended matter and then it passes through the ultra-violet ray sterilizer. This apparatus is similar to the Luneville unit except for its size, as it contains only two 220-volt pistol lamps. It is rated at 175,000 gallons capacity per day. Tests at the outlet of the sterilizer show only a few germs, and tests of the water going to the purifying apparatus have improved from 6,000 germs per cubic centimeter to about 350 germs per cubic centimeter since the introduction of the ultra-violet ray apparatus.

The smallest lamp used in the above apparatus operates at 110 volts with two amperes. The largest made so far is for 500 volts, 2.5 amperes. The largest apparatus built contains ten of the last-mentioned lamps. The power consumption in such a case, with a very large safety coefficient for the sterilization, is between 50 and 130 kilowatt-hour per million gallons of water. This amount of power is evidently not very great but it will always do something to smooth out the load curve of a power station, as, in most cases, such apparatus will be operated continuously. Many installations of this kind have been made in Europe for both small and large water works, and they are operating very successfully. Their simplicity and rapidity of action have proven highly satisfactory in all installations.

Cleaning Stone Work

A builder had a contract involving the use of brick work with granite trimmings and he found it necessary to clean the stone work. He made the attempt with dilute acid, but it did not give satisfaction, although the stock brick around the trimmings cleaned up very nicely. The granite, however, still showed the streaks of dirt. He stated his case in a recent issue of The Painters' Magazine and the suggested remedy was as follows:

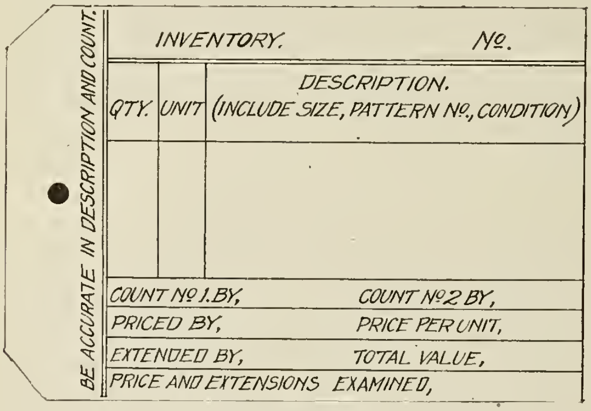
Builders' acid, which is equal parts of muriatic acid and water, will remove spots of mortar on brick or stone work, but is not the right material for cleaning stone that is begrimed fro msmoke and dirt. To accomplish this, apply to the surface, with a long-handled fibre brush, a strong solution of caustic soda or pearl ash. Let it remain on for about fifteen minutes, then wash several times with clear water, using a stiff brush or broom for the purpose. If this will not be effective enough, scrub the stone with a stiff fibre brush, using soft soap and concentrated lye and sand, allowing this to remain on the stone until nearly dry, then rinse with clear water, using a brush to remove the cleansing material.

A reinforced concrete pontoon, for a landing stage for ferry service, has recently been put into use in the harbour of Sydney, Australia. The pontoon is 100 ft. long, 43 ft. wide at one end and 68 ft. at the other, 7 ft. 9 in. deep, with a 32-in. freeboard. The bottom is flat, and the sides and ends are sloped to an angle of 70 deg. Special attention was given to the design of the reinforcement, with a view to enable the construction to withstand the excessive forces likely to occur should vessels be berthing at each side of the pontoon at the same moment. In the construction of the top and bottom of the pontoon, allowance has been made for a live load of 150 tons, which will be distributed over the centre length between the posts. The whole structure is divided into forty-eight water-tight compartments by solid reinforced concrete walls. It weighs about 650 tons.

The Organization and Management of a Stores Department

By W. G. Astle*

THE Stores or Stock Department of any business is that section which has the custody of its stock-in-trade, materials, supplies, and other physical property, except real estate. This department when scientifically organized and managed becomes one of the most valuable from a profit-making standpoint, but, without the proper organization and management it may degenerate into one of the most useless. The organization and system must be of the very best to attain the state of efficiency of which it is capable, and like every other department of a business, the organization depends largely upon the nature of the business.



BE ACCURATE IN DESCRIPTION AND COUNT.

INVENTORY. Nº.

QTY.	UNIT	DESCRIPTION. (INCLUDE SIZE, PATTERN Nº, CONDITION)

COUNT Nº 1. BY, COUNT Nº 2 BY,
PRICED BY, PRICE PER UNIT,
EXTENDED BY, TOTAL VALUE,
PRICE AND EXTENSIONS EXAMINED,

Fig. 1.—Inventory cards.

What is Material?

Material is the first great factor in the cost of a thing to the producer, and may be classified as Raw Material, Finished Commodity, and Accessory Material.

Raw Material may be defined as any material for use in process before it has been subjected to that process. Finished Commodity designates any industrial product which is introduced, without substantial charge, into the composition of another product, usually as an accessory part. Accessary Material is material necessary to a process, yet not actually entering into the completed product, and is commonly considered a part of general manufacturing expense, particularly if the material is used again and again, and not directly chargeable against any one particular job.

Two Types of Organization

The aim of any organization should be to systematically unite each individual into a body purposed to work together for one common end; to unite in reciprocal and concrete relation and duties; and to bring into systematic connection and co-operation parts of a whole. This is the first necessity of any organization, either commercial or industrial.

The elements of any organization are men, equipment, and space. You have an efficient organization when the elements are combined in such a manner that they will operate harmoniously, accurately and promptly, and will achieve the result required with the least expenditure of money and effort.

Organization can be divided into two kinds, military and functional.

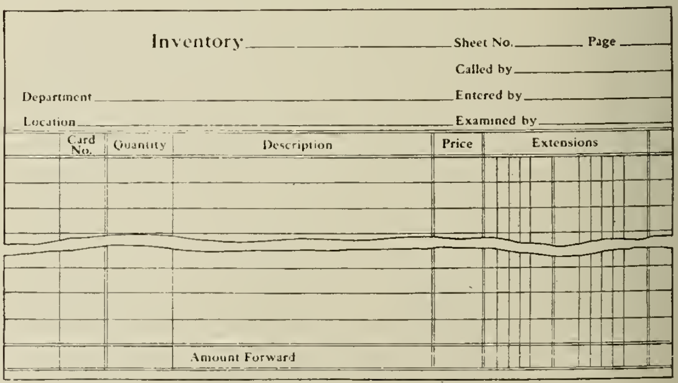
Functional organization is a type of organization that gives each worker, whether executive or clerk, as few functions as possible to perform. Major Charles De Lano Hine, in his book "Modern Organization," describes the unit system of organization employed on the Union Pacific Railway, which is a type of functional organization peculiarly adaptable to the railway business by reason of its scattered forces.

Military organization is a type of organization where one man has supreme authority over a branch of the company's work. Mr. F. W. Taylor, in his book, "Shop Management," points out that this type of organization is inefficient, because if the man's duties were properly fulfilled, he would actually be an expert in many branches of business knowledge. The foreman who hires and fires, plans the work, supervises the cost accounting system and has charge of new construction, operates under this plan.

The organization of a storeroom, however, will have to be modeled according to the conditions found in the individual establishment.

Scientific Management as Applied to a Storeroom

Scientific management has passed the stage of experiment and has firmly established itself in many of the greatest industries. Men have been slow to grasp the significance and tremendous possibilities of the scientific means of doing work in all branches, but the survival of over thirty years of a movement of this character through all the opposition, objections and difficulty strewn in the path of any innovation gives trustworthy evidence of the soundness of the ideas and a fair prophecy of their extensive application in the near future.



Inventory ________ Sheet No. ______ Page ______
Called by ______
Department ________ Entered by ______
Location ________ Examined by ______

Card No.	Quantity	Description	Price	Extensions
		Amount Forward		

Fig. 2.—Inventory record taken from cards, Fig. 1.

The physical aspects of a storeroom under this style of management do not differ very much from any well systematized storeroom. A proper means of storing and piling the material, laid out in an orderly fashion should be provided. To avoid confusion in a varied terminology, mono-meaning symbols should be used to designate the different kinds of material. The maximum and minimum should be determined for each kind and kept on the stock ledger sheets or cards.

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* Storeskeeper, Toronto Electric Light Company.

Under this style of management it is not enough, when material is required, to send a requisition to the Stores Department, but all orders for work that require material should have the items booked up and assigned to the specific orders by the Storekeeper, and this material, when assigned to a given order, should not be available for any other orders which may follow. This should be done before the material is required for use and will serve as an advance notice to the Storekeeper should any unexpected demand for a particular material occur.

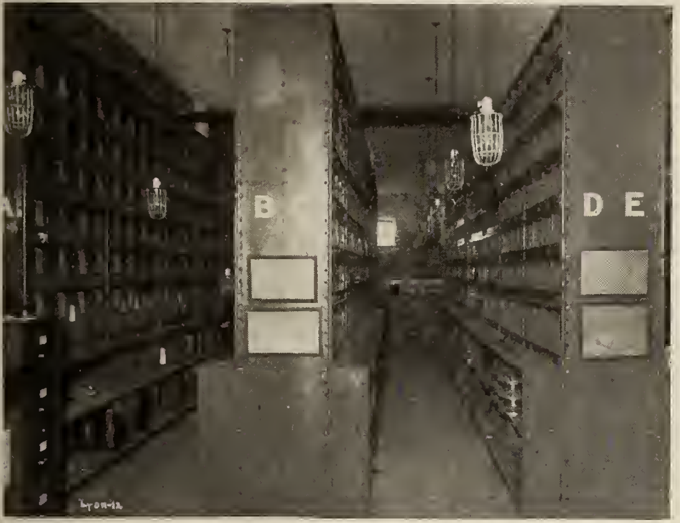


Fig. 3.—Storage adjustable shelving.

The work of moving materials into the storeroom and moving them to the particular place where they are to be used, becomes a function of the planning of the work, and of the routing of the work, and the man who is to use them should not be delayed or have to give a thought to the materials which he needs for his next job. They should be moved in the right condition for his use to the point where he can use them to best advantage. The time which the man spends looking or waiting for his material can be better spent in effective work.

Inventories

Before a system of stock records can be successfully installed, a complete inventory must be taken, and from this is formed the basis on which the records are founded. When once this inventory is taken and properly recorded, it is possible to install and maintain a system which will make it unnecessary to take an inventory of all the materials at any one time. The chief requirements of an inventory are exactness in description, enumeration, and appraisal.

Several gangs of men working together in different parts of a storeroom make it impracticable to take a consecutive list of the materials on hand, therefore it appears best to make the original records on cards, one for each lot of similar items. These cards, Fig. 1, should be numbered consecutively, and should be provided with a hole punched at the centre near the top, for attaching a string, as with the ordinary shipping tags.

Before beginning an inventory all the men should be called together and given instructions in the methods to be followed, and foremen should be selected for the various gangs and assigned to the materials with which they are the most familiar. They should also be instructed to commence at a suitable point and progress regularly. The foreman of each gang will then record the date for each lot on the cards, and check the count of his helpers, after which he will attach the card to the material. This procedure is followed until every different article in the storeroom is tagged. This is only a preliminary count and the work in the storeroom should not be interrupted to any great extent. The man who takes out any material should change the tally memorandum on the card for any lot of material already counted.

On the date decided upon for the inventory, the work should be changed around so that a different force of men will go over the work done by the gangs in the first round. This second gang will take off the cards attached to each lot, verify the condition and number, and proceed as rapidly as possible. It should not be necessary for this second gang to check every piece of material, but only to test occasional places at random, or to satisfy themselves in some way that the cards give an accurate record of the material they represent. When these cards are all checked and removed, they should then be sorted numerically, to make certain that they are all accounted for, after which they can be arranged in any way that will simplify the operation of pricing. After they have all been priced, checked, and arranged in whatever way desired, the inventory can then be typewritten on loose-leaf sheets, Fig. 2, and bound for future reference.

Perpetual Inventory Plan

The old custom of making inventories but once a year is fast becoming obsolete, due to the fact that under that system little opportunity is given to trace losses in any department, and to the difficulty of going over the entire amount on hand at any one time. A better arrangement, and one which commends itself to the practice of to-day is commonly called a perpetual inventory. To adopt such a plan, it must be first ascertained the number of kinds of material in stock, and a schedule arranged whereby a certain number of items are counted each day during the year, and compared with the stock sheets or cards; if necessary they should be immediately readjusted. The result of this method will be that no extra effort will be required, and the work can be done by the storeroom

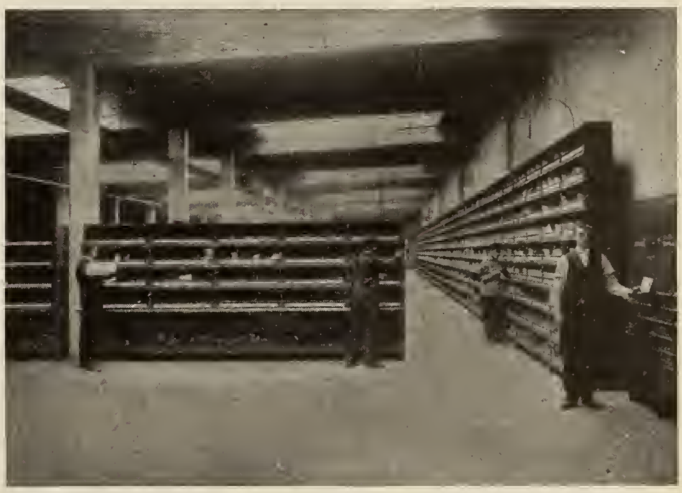
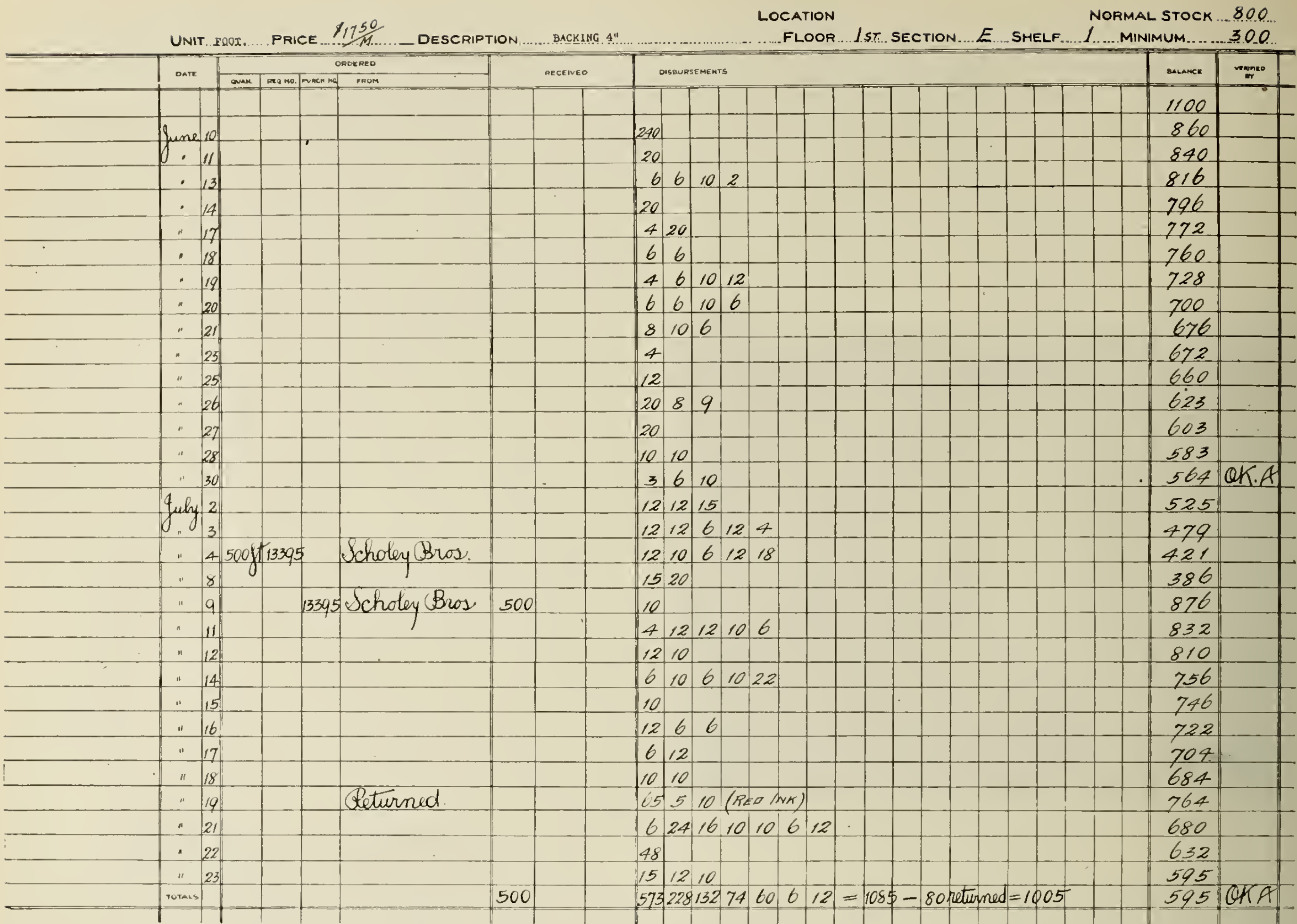


Fig. 4.—Storage adjustable shelving.



UNIT Foot. PRICE $17.50/M DESCRIPTION Backing 4" LOCATION FLOOR 1st SECTION E SHELF 1 NORMAL STOCK 800 MINIMUM 300

DATE		ORDERED				RECEIVED	DISBURSEMENTS	BALANCE	VERIFIED BY
		QUAN.	REQ. NO.	PURCH. NO.	FROM				
								1100	
June	10						240	860	
"	11						20	840	
"	13						6 6 10 2	816	
"	14						20	796	
"	17						4 20	772	
"	18						6 6	760	
"	19						4 6 10 12	728	
"	20						6 6 10 6	700	
"	21						8 10 6	676	
"	23						4	672	
"	25						12	660	
"	26						20 8 9	623	
"	27						20	603	
"	28						10 10	583	
"	30						3 6 10	564	OK. A
July	2						12 12 15	525	
"	3						12 12 6 12 4	479	
"	4	500 ft	13395		Scholey Bros.		12 10 6 12 18	421	
"	8						15 20	386	
"	9			13395	Scholey Bros	500	10	876	
"	11						4 12 12 10 6	832	
"	12						12 10	810	
"	14						6 10 6 10 22	756	
"	15						10	746	
"	16						12 6 6	722	
"	17						6 12	704	
"	18						10 10	684	
"	19				Returned		65 5 10 (RED INK)	764	
"	21						6 24 16 10 10 6 12	680	
"	22						48	632	
"	23						15 12 10	595	
TOTALS						500	573 228 132 74 60 6 12 = 1085 — 80 returned = 1005	595	OK A

Fig. 5.—Stock Ledger sheets, showing only units.

staff, who are thoroughly familiar with the different materials handled almost daily in filling orders.

There is no real reason why an actual inventory should be required at any one time. If the Storekeeper has a check, from time to time, of the actual stock on hand to compare with his stock records, it is just as practical as though all his information was supplied to him at one time. On the other hand, this plan has many advantages in that it does not interfere with the routine filling of orders, it does not require the employment of additional help in the storeroom who are not familiar with the material in stock. In actual operation, the above plan is not only feasible, but it has proved most desirable from an efficiency and economy standpoint.

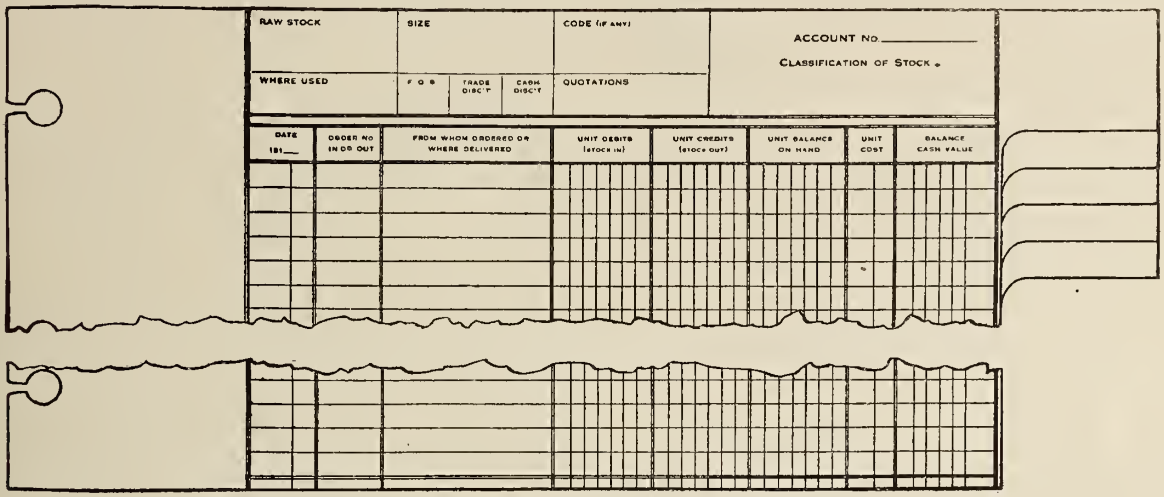
Storage, Shelving and Racks

This is one of the most important points to be dealt with when installing an up-to-date storeroom system, and very often there is not enough importance attached to this feature of storeroom facility. In quarters which are crowded, and have not the proper kind of storage bins and shelving, the difficulty of keeping track of the materials needed is increased. Materials will be ordered when a sufficient quantity is already on hand, but cannot be located; or some special line will be overlooked entirely until the last moment, when it is required. This item of storage is deserving of more than passing notice, for thousands of dollars will be spent, and maybe wasted, if great care is not exercised in keeping the supply of materials up to the requirements.

Nearly everyone will agree with the writer, that the advantages of steel racks and adjustable shelving over wooden equipment are very great. In the opinion of the writer, the best steel equipment for storeroom racks and shelving on the market at the present time is the "Lyon," Figs. 3 and 4, which are manufactured in Aurora, Illinois, by the Lyon Metallic Manufacturing Company. The main features in the "Lyon" racks are their strength, simplicity, and adaptability; they are fireproof, permanent and occupy much smaller space than the wooden equipment. They are made in standard sizes and one or more sections are complete in themselves, which enables you to gradually increase your storing facilities as business demands, or they can be taken down at any time and assembled in another position.

Each section of bins or racks should be given a letter and each individual bin or shelf a number, so as to enable the location of the materials to be specified on the stock records.

The question of what is a proper storage place and the laying out of the floor space is one which must be worked out to fit the conditions as found in the individual establishment. In a manufacturing business the materials should be located as near as possible to the departments in which they are used. In the larger plants it is sometimes necessary to have several storerooms to accommodate the various classes of material, and in order that they may be located conveniently. The question of proper storage is a vitally important one in every business, and especially so in a manufacturing plant. Ideal conditions are impossible to obtain in all plants, but the very first consideration should be to have a definite place for every class of material, and always keep the class in that one place. The question of the size and weight of the material, and the frequency with which it will be needed, should be the first consideration. Extremely heavy articles should not be stored on the floor, but should be raised to about the height of a truck, which will save labor in loading and unloading. Material which is constantly called for should be kept on shelves within easy reach. The top shelves and inaccessible corners should be reserved for the articles which are seldom called for. As far as possible, all material of the same class should be kept in the same location or section of the storeroom. Above all, a given article should always be kept in the same place.



RAW STOCK	SIZE	CODE (IF ANY)	ACCOUNT No. ________
WHERE USED	F.O.B. / TRADE DISC'T / CASH DISC'T	QUOTATIONS	CLASSIFICATION OF STOCK.

DATE 191__	ORDER NO IN OR OUT	FROM WHOM ORDERED OR WHERE DELIVERED	UNIT DEBITS (STOCK IN)	UNIT CREDITS (STOCK OUT)	UNIT BALANCE ON HAND	UNIT COST	BALANCE CASH VALUE

Fig. 6.—Stock ledger sheets, showing both units and values.

The Storekeeper and His Duties

The Storekeeper, under the direction of the Purchasing Agent (or in some plants he should be under the Superintendent) should have full charge and authority in the Stores Department. He should have charge of all assistants and storeroom clerks, and must render receipts to the Accounting Department for the entire intake and output of all material and supplies. All requisitions for material and supplies should be made by him, to the Purchasing Agent, and in some cases the requisition should be accompanied by a record of the material on hand at the time of requisition. He should be solely responsible for the maintenance of a perpetual stores inventory system, and for keeping it posted up-to-date. A storekeeper must, above all things, be exacting, and have such complete control over the men in his employ that the slightest infraction of rules will mean the equivalent to a final check. He should be a man exceptionally well qualified for the position, capable of protecting the company's property to the letter. He should be familiar with the materials, and know their uses, but it is not necessary that he should be a skilled mechanic. On the other hand, he should not be simply a bookkeeper, or he may be unable to suggest uses for certain material, and as a result, a lot of dead stock will accumulate, much of which might be employed for some purpose if brought to the attention of the proper parties.

LOW STOCK REPORT.

Mr.......................Storekeeper. Date...............

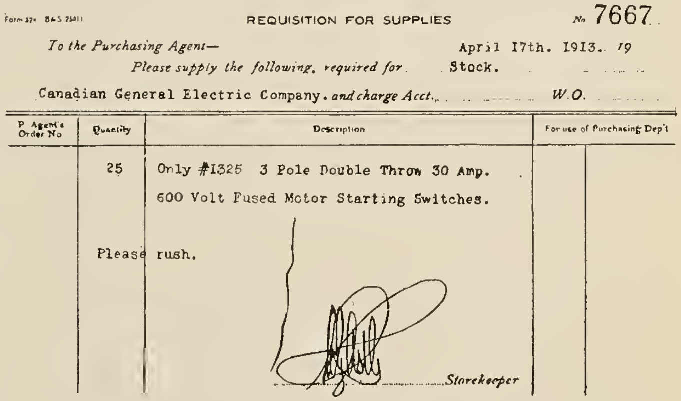
The following items have reached the low limit.

.... Inventory Clerk.

	Low Limit.	On hand.	Material.	Remarks.

Fig. 7.—Low stock report.

Aside from the storeroom proper, the Storekeeper should have charge of all material which is stored outside. Lumber, fuel, and heavy castings are examples of material which comes under this head, and his records should include all of this material, and he should have general supervision over its storage in order that he may more readily determine quantities in stock.



Form 37a 8&S 7M11 REQUISITION FOR SUPPLIES No 7667

To the Purchasing Agent— April 17th. 1913. 19

Please supply the following, required for Stock.

Canadian General Electric Company. *and charge Acct.* .... *W.O.* ....

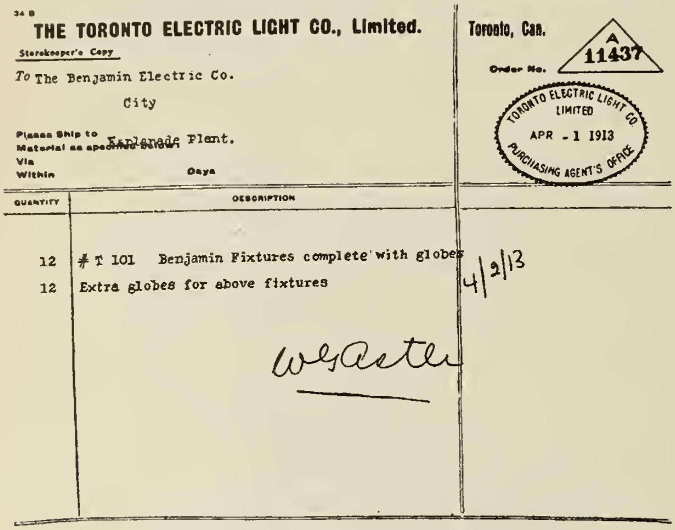
P. Agent's Order No	Quantity	Description	For use of Purchasing Dep't	
	25	Only #1325 3 Pole Double Throw 30 Amp. 600 Volt Fused Motor Starting Switches.		
	Please	rush.		

Storekeeper

Fig. 8.—Requisition from storekeeper.

Stock Records

The purpose of a stock record system is to account properly for all material purchased and used; but the location of the storeroom, its relation to the department served, and the ability and experience of the Storekeeper, may necessitate certain changes in details to meet local conditions. A theoretical system may be outlined which will afford a perfect record, but, when put into practice, it may prove unsatisfactory, or it may be too expensive for the protection afforded. A practical test is always advisable before a decision is made upon a stock record system for any business. The installation of a stock record system calls for the exercise of judgment of the highest order, for the record of sock, material or supplies, is of no less importance than the record of cash, and should be accounted for with the same fidelity as cash. A dollar's worth of material should be registered as a dollar in gold.



34 B
THE TORONTO ELECTRIC LIGHT CO., Limited.
Storekeeper's Copy
To The Benjamin Electric Co.
City
Please Ship to Material as specified below Esplanade Plant.
Via
Within Days

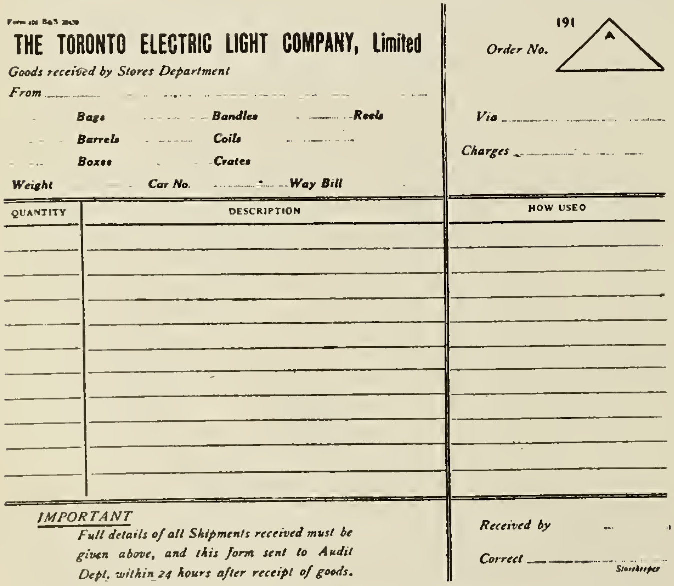
Toronto, Can.
Order No. A 11437

TORONTO ELECTRIC LIGHT CO. LIMITED
APR - 1 1913
PURCHASING AGENT'S OFFICE

QUANTITY	DESCRIPTION	
12	# T 101 Benjamin Fixtures complete with globes	4/2/13
12	Extra globes for above fixtures	

Fig. 9.—Storekeeper's copy of purchase order.

Stock sheets, Figs. 5 and 6, or cards filled topically (or numerically if a symbol system is used) should be kept for each article in stock, and should show the unit, full description, location in the storeroom, normal stock and minimum stock; date, requisition number and quantity ordered; purchase number and name of the firm from whom purchased, dates and quantities received, and the dates and quantities given out, from which a record every day can be obtained of the quantities on hand and quantities on order.



THE TORONTO ELECTRIC LIGHT COMPANY, Limited
Goods received by Stores Department
From
Bags *Bandles* *Reels*
Barrels *Coils*
Boxes *Crates*
Weight *Car No.* *Way Bill*

191
Order No. A
Via
Charges

QUANTITY	DESCRIPTION	HOW USED

IMPORTANT
Full details of all Shipments received must be given above, and this form sent to Audit Dept. within 24 hours after receipt of goods.

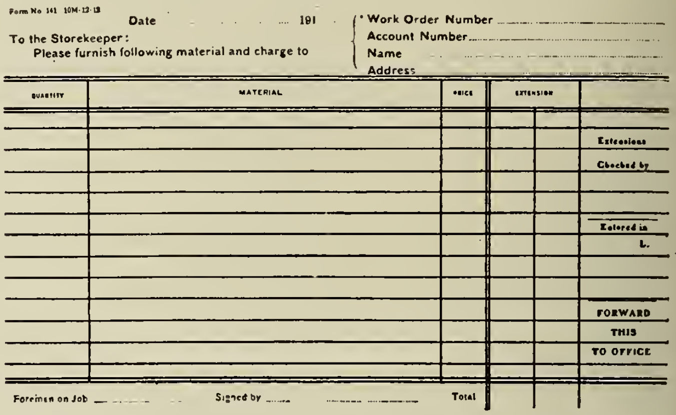
Received by
Correct *Storekeeper*

Fig. 10.-Receiving report—Storekeeper to auditor's department.

Low stock report forms should be kept in the bins so that the stock clerk removing material is automatically notified that more should be ordered when the minimum quantity is reached.

Ordering Material for Stock

Every article of material should be given a low limit, and when this limit is reached, the stock record clerks should make out a Low Stock Report, Fig. 7, to the Storekeeper. This in turn should be verified by the storeroom foreman, and is recognized as a notice to order more. The report should show the low limit and the quantity in stock. The low limit should always be given, for in some instances it is found advisable to change the limit. Material formerly used in large quantities may be found to be in so little demand that it will be necessary to reduce the limit. At other times it might be found advisable to increase the limit. Before replenishing his supply of any material, the Storekeeper should consult the head of the department using the material to determine if any change in the specification will be made. Failure to do this sometimes causes the storeroom to become overstocked with obsolete material or material that has become useless on account of changes on standards adopted. When obsolete material accumulates it should be sold, as it seldom improves with age.



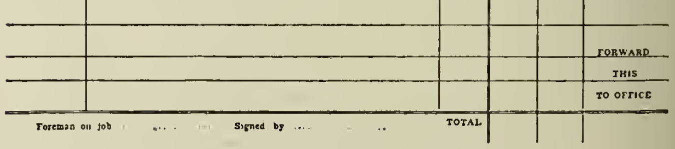
Form No 141 10M-12-13
Date 191
To the Storekeeper:
Please furnish following material and charge to
* Work Order Number
Account Number
Name
Address

QUANTITY	MATERIAL	PRICE	EXTENSION	
				Extensions
				Checked by
				Entered in
				L.
				FORWARD
				THIS
				TO OFFICE

Foremen on Job Signed by Total

Fig. 11.—Requisition form, when material is withdrawn.

All orders for material should be made on a requisition form similar to the one shown in the illustration, Fig. 8. These requisitions should be made in duplicate, one copy being forwarded to the Purchasing Agent, the duplicate being retained by the Storekeeper, and held for the Storekeeper's copy of the purchase order, Fig. 9, after which they should be filed away under the name of the firm with whom the order is placed, to await deliveries.



Date 191
To the Storekeeper:
Please receive the following material and credit to
Work Order Number
Account Number
Name
Address

QUANTITY	MATERIAL	PRICE	EXTENSION	
				Extensions
				Checked by
				Entered in
				L
				FORWARD
				THIS
				TO OFFICE

Foreman on Job Signed by TOTAL

Fig. 12.—Credit form, when material is returned.

Receiving Material Into the Storeroom

The Receiving Clerk should have charge of all materials received in the storeroom; he should unpack, make proper preservation of packing material and lumber for future use, check over entire receipt in detail. Under no circumstances should the consignor's invoice be given to the Receiving Clerk to check from, as this too often leads to check marks on the invoice without a count of the material. His memorandum of receipt, Fig. 10, should contain an account of all items and statements, and should be compared with consignor's invoice in the main office entirely independent of him. This method insures absolute certainty regarding the correctness of the amount and quality of the materials received.

After each order has been completed, all papers, from the requisition to the receiving report, which pertain to the order, should be collected, fastened together, and filed away under the order number, while a record should be kept of all order numbers showing the names of the firm on whom the orders were placed.

Disbursements of Material

No material should be drawn from the storeroom except on a requisition properly signed and approved by the foremen of the different departments, and all material issued and not used should be returned to the storeroom and the proper credit given. Requisitions, Fig. 11, on which material is given out, should show the use to which it will be put, and the name of the operating expense or other account chargeable. They should all be numbered consecutively, the original being sent to the Accounting Department, and the duplicate retained by the Storekeeper for making the necessary records on the stock records, after which they should be filed under the account chargeable. Materials returned to the storeroom should be accompanied by a credit slip, Fig. 12. This form should go through the same routine as the requisitions or charge slips.

Handling of Scrap Materials

The handling of second-hand material and scrap is very important, and unless a proper record is taken of all second-hand and scrap material as soon as it begins to accumulate considerable loss will result. All scrap should be collected and stored promptly, and as soon as it accumulates it should be sold, as it is very seldom that old material improves with age, and while fluctuations in the price of metals may warrant the holding of some material for a short time, it is not desirable to keep it indefinitely in the hope that prices will go up.

General Observations

Some may think that an elaborate system of stock records requires too much work and provides too many records, but shortages in material are just as expensive as shortages in cash, and there is no reason why one should not be safe-guarded as much as the other. Managers of some factories jealously guard the cash collected daily, which amounts to a few thousand dollars, and it is placed in a bank promptly; even petty-cash accounts must balance to the cent. Let them exchange their cash for material and, beyond checking bills, interest often flags. The Storeroom of any well-organized plant is deserving of the attention and study of every live manager, since much money may be saved by the operating on an efficient basis of this branch of the plant. It is better to have a few extra records and protection than to omit these records and take chances of shortages. In a corporate business, it is the small items which must be closely watched to insure the accomplishment of the greater and bigger tasks which follow business development. Things that seem trivial to the average employee really mean a great deal in the long run if abuses occur, and the old adage, "A stitch in times saves nine," applies very appropriately to the safe-guarding of storeroom materials.

No steel reinforcement should be painted or oiled. Some engineers have required that all reinforcement be dipped in a bath of cement grout before being installed in the forms, but by careful manipulation during the placing of the concrete this extra handling and cost are unnecessary and may be done away with.

The new steel conduit now being completed for augmenting the water supply of Atlantic City is being used as an effective advertising medium. For about a mile the pipe parallels the line of the Pennsylvania Railroad, and, being entirely above ground, makes an excellent signboard. The Chamber of Commerce has painted large signs on it at intervals of about 300 ft., extolling the advantages of the city as a summer resort. The scheme is effective, for travellers follow the successive signs with much interest.

The United States army engineers have long used the following mixture for water-proofing cement: One part of cement, two parts of sand, three-quarters of a pound of dry powdered alum to each cubic foot of sand. These are mixed and dried and to them is added water in which has been dissolved three-quarters of a pound of soap to each gallon. This, it is said, is nearly as strong as ordinary cement, and is quite impervious to water, and does not effloresce. For a wash, a mixture of one pound of lye and two pounds of alum in two gallons of water is often used.

Segregation (separating the stone from the finer material) must be avoided in depositing concrete through chutes. On account of the velocity which the larger stones attain in passing down the chute, they generally fall some distance in front of its mouth, whereas the mortar, sliding gently down, drops vertically from the mouth, thus counteracting to a great extent the labor bestowed in carefully mixing the ingredients. This will necessitate remixing the concrete immediately after it reaches the bottom of the chute; but no time must be lost either in the original mixing or in the depositing, if this second mixing is to do any good.

Bending reinforcing rods is accomplished very simply and satisfactorily at Balboa by an arrangement somewhat similar to the rail-bending machine. The rods are bent by the thrust of the piston-rod of an engine cylinder while the rods are held in place on a table in front of the cylinder. The table is a steel plate bored with numerous holes, wherein are placed moveable steel pegs for limiting the bending. Two such equipments are in use; one includes a single 10-in. cylinder recovered from an old French locomotive. This outfit places a single crimp in three or four ¾-in. rods simultaneously. The second equipment employs two 14-in. cylinders taken from the dumping mechanism of a 2 cubic yard concrete mixer, which are mounted on opposite sides of the table, and make opposite bends in rods as large as 1¼-in. in diameter. In both cases compressed air is used at a pressure of about 80 lbs. per square inch. It is claimed that five men in one hour can bend as many rods as they formerly did in eight hours.

Deep Water Concreting Through a Tube

Notes on the Tremie Method and Suggestions of Various Expedients to Avoid the Difficulties Likely to be Encountered

By E. B. Van De Greyn

SOME time ago in a short article on a method of starting deep-water concreting through a tube it was stated that, "as is well known, unless the tube is sealed in some way the cement will wash out during the downward passage and leave only a pile of stone and sand. This waste of concrete may in the case of a 12-in. tube 30 ft. long amount to more than 1 cu. yd."

It is plain that if the tube is filled by dumping little batches (such as wheelbarrow loads) the concrete in each small batch will be washed until the water in the tube is absorbed or forced out at the top. If, however, a large batch of concrete, sufficient to fill a considerable length of the pipe, say 30 or 40 ft., is dumped at one time into the hopper of the tremie I would not expect the concrete to be washed as stated above—that is, if the procedure of charging outlined hereafter is followed.

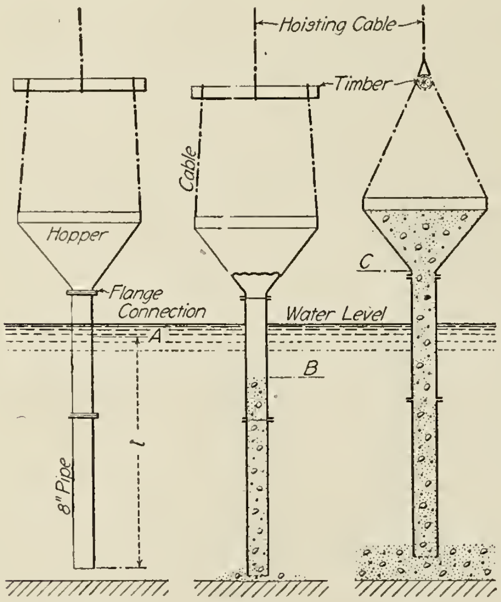


Fig. 1 Fig. 2 Fig. 3

Tremie empty, sealed and ready to be shipped.

Experimental Tremie

A laboratory experiment with a miniature tremie was tried by the writer. The tremie consisted of a glass tube 1 in. in inside diameter and 12 in. long and a tin funnel cut to fit the top. A china plate was placed in the bottom of a water bucket partly filled with water. The glass tube was clamped to a standard with its lower end 5 inches below the water surface and 3/8 in. above the china plate. A batch of mortar was made up of 1 part of cement and 2 parts of standard Ottawa sand, the mortar being made quite wet so as to flow freely through the tube. The batch of mortar was dropped into the hopper several times with the same results. In each case the water was driven out of the tube ahead of the mortar and the mortar spread out over the plate and filled the lower part of the tube. In each case there was no washing out of cement. The mortar extended about 5 in. up in the tube. A depth of water of 5 in. is small compared with 40 or 50 ft., but the experiment shows what might be expected.

Sealing the Pipe

There is no doubt that preliminary sealing of the pipe in some way is the safe way to proceed to charge the pipe for the first time. Under certain conditions of concreting under water I would consider that a layer of shavings and sawdust with a layer of cement on top should be placed in the pipe before starting the concrete, but in some instances the plug might be dispensed with. For example, consider the conditions on one job under the writer's charge. A large open caisson had been sunk to a depth of about 50 ft. below water level in alluvial soil, the caisson had been dredged out and piles driven within, and finally the soil that was forced up during driving had been removed. The excavation was carried a little lower than depth required on the plans. The concrete placed immediately on the bottom would mix with the mud and form a base for the remaining concrete required on the plans, and due to the large mass of concrete to be placed in the caisson it was not necessary often to change the position of the tremie in a horizontal direction. Under such conditions I believe charging the tremie according to the method outlined below was ample protection against washing out of the cement.

The following method of deep-water concreting has been used under the charge of the writer: Inspection after pumping out the water has always revealed the top concrete to be first class. The method and equipment, together with precautions to be observed, are submitted with the hope that some of the ideas may be of benefit to those who may find themselves for the first time in charge of such work.

A tremie is shown in Figs. 1, 2 and 3 made up of sections of water pipe with bolted flange connections and a metal hopper large enough to hold one batch of concrete. The hopper is bolted to the top section of the pipe. All connections are made water-tight by means of gaskets. An 8-in. pipe has proved practicable and has the advantage over larger pipe in being lighter. The view shows a tremie used on the city waterway bridge at Tacoma, Wash. The International Contract Company was the contractor, Waddell & Harrington were the consulting engineers representing the city and the writer was resident engineer for Waddell & Harrington. The same tremie was used on the Puyallup River bridge at Tacoma.

On one job the tremie was raised and lowered with the hammer line of the pile driver stationed on falsework over the caisson. This proved very satisfactory, as the up-and-down movement of the tremie was under perfect control, and such control is important in tremie work. On another job the tremie was suspended from the load line of a barge derrick. This proved serviceable, but not so satisfactory as the pile driver because of swaying of the tremie due to wave action on the barge, and due to tipping of the barge at the time of raising the tremie.

In charging the tremie a large batch capable of filling a considerable length of the pipe should be discharged into the hopper at one time. At Tacoma the concrete was discharged from the mixer into a concrete bucket and the concrete bucket swung over the hopper of the tremie by a derrick. Where the contractor is not equipped with a derrick a contractor's concrete cart holding a large enough batch could be used, or if wheelbarrows are used a hopper with a trap door would serve the purpose of discharging a large batch suddenly into the tremie hopper. After the pipe is once sealed the concrete from then on can be dumped into tremies in large or small batches.

Concrete Should be Mushy

Concrete deposited in deep water through a pipe should be of a mushy consistency in order that it may flow easily after leaving the end of the pipe under the surface of concrete just previously deposited; it will then spread more evenly after leaving the pipe, thus avoiding the formation of hillocks and making it unnecessary to change the position of the tremie in a horizontal direction as frequently as would be the case if drier concrete were used. Also, it will not choke the pipe. A little experimenting at the outset will soon indicate how much water should be used in each batch. After the proper amount is determined it should be regulated by a gauge so as not to vary, consideration being given, of course, to appreciable changes in the amount of moisture in the aggregate.

Mushy concrete deposited in water should have an excess of cement. There is a loss of cement due to the excess water in the concrete finding its way out, carrying a portion of the cement, which is found in the laitance on top. A 1:2:3 mix is recommended; this is the mix specified by Waddell & Harrington for mass concrete deposited under water through a pipe.

Operation

In the illustration Fig. 1 shows the tremie ready to receive the first batch, the bottom of the pipe being raised from 6 to 12 in. above the bottom of the excavation, so that the water may escape as the concrete comes down the pipe. It is well to land the pipe on the bottom and then raise it so that one is assured that it is above the bottom. Assume that one batch would fill the pipe for a length l, that is, when the concrete begins to emerge from the end of the pipe the top surface is at level A. If the pipe is to have a plug of planer shavings and cement they should be in place before dumping concrete into the pipe. Charging the pipe is the most difficult part of deep-water concreting through a tube, hence it should be supervised by some competent person. If the pipe is dropped before concrete emerges from the lower end the water in the lower part of the pipe cannot escape and it boils up through the concrete, washing out the cement. Whether a new charge or the absorption of this water by additional drier concrete is better must be determined by judgment, and the amount of such water should decide which will result in the lesser waste. If the dropping of the pipe in making the first charge is delayed too long all the concrete escapes, which means that one batch is partly lost and the operation must be repeated. After the batch is dumped into the hopper, when the surface of the concrete drops to level A, the tremie should be dropped. By the time the pipe is dropped to the bottom the surface of the concrete will be below level A, as indicated in Fig. 2, and the tremie will be sealed.

After the pipe is sealed with concrete as shown in Fig. 2 the remainder of the pipe and hopper can be filled as shown in Fig. 3. Next the tremie should be raised slowly until the concrete flows downward. It is not safe to raise the pipe continuously until the concrete begins to flow, because by the time the "stop" signal is obeyed the pipe will have been raised too far and there will be a sudden rush of concrete through the pipe, with accompanying danger that the pipe will not be lowered quickly enough to prevent all concrete from leaving the pipe and leaving it unsealed. Therefore the tremie should be raised a few inches and held, and then raised again a few inches and held, repeating until the correct vertical position is found where downward movement will begin; the concrete will then slowly lower in the pipe and will emerge from the bottom under right conditions. All this can generally be done in short time and will cause no delay at the mixer, especially after the men become familiar with the work. When the surface of the concrete lowers to some level, say C, at which it is desired to stop the flow, the tremie is lowered and the flow ceases. There is some definite point at which the pressure on the end of the pipe due to head of water and concrete outside of the pipe plus the resistance of the concrete to move through the pipe is equal to the weight of the concrete. It is to locate this point that the tremie should be raised a little at a time as described in the foregoing. Concrete can thus continue to be placed under water without passing through water, avoiding all wash, emerging as it does from the pipe under the surface of the concrete just previously placed. It is well never to let the surface of the concrete go below the bottom of the hopper, since it is then always in sight; if it is allowed to go below this the next batch confines the air in the tube, most of the air bubbling up through the concrete.

Precautions

See that all connections are watertight. Lash the several sections of the pipe together with cable so as to be able to save them if they break loose. Examine the connections whenever possible to see that they are not broken. If a connection were broken and the break large enough to let concrete through great damage would result by concrete flowing through the break and dropping through the water, causing segregation of the constituent materials. After starting concreting keep it up continuously until completion and regulate the moving of the tremie horizontally so as to keep the laitance on top where it can be removed later. After the water is pumped out, clean the surface of the concrete thoroughly so as to remove all laitance and furnish a good surface on which to start other concrete work.

There appeared recently an instructive article by R. C. Miller on the tremie method of concreting in deep water in connection with building the new Pensylvania bridge over the Maumee River at Toledo. In view of the similarities and differences in experience on that job and work done under the writer's direction a discussion of some of the methods used at Toledo may be of value.

As described by Mr. Miller, there was used on the experimental pier a 14-in. tremie with a ½-yd. receiving hopper, the hopper being fed from a 15-in. delivery pipe leading from another receiving hopper, which in turn was fed by a ¾-yd. bucket from the 1-yd. mixer. It was stated that the pipe, when filled with concrete, would not free itself until the end had been pulled nearly out of the concrete previously deposited and that when it did start it went with a rush, the quick release of the load at the instant of starting causing the derrick boat to fall back from its tipped position and lift the pipe clear of the concrete, with resultant loss of the charge and filling of the pipe with water. Also, in attempting to "drown out" or absorb the water in the pipe the concrete overflowed the hopper and backed up in the delivery pipe. Later a 20-in. tremie pipe with a 1-yd. hopper was used and the difficulties, though not entirely overcome, were greatly decreased, the laitance deposit being reduced to 2 or 3 in.

Eight-Inch Pipe Ample

In the first case—that is, where the 14-in. pipe was used—it occurs to the writer that the difficulties were occasioned by the following things: First, since this kind of work has been done successfully with an 8-in. pipe lack of sufficient water in the concrete will probably explain why the concrete would not flow until the end of the pipe was pulled nearly out of the concrete previously deposited. A dry concrete would flow with difficulty through the pipe, and the concrete previously deposited, being also not wet enough, would require more applied force to cause it to be displaced, thus adding to the difficulty. Second, in raising the pipe with the barge derrick it was probably not raised a little at a time as recommended above, so that the tremie was not properly controlled in its vertical movements. Third, when the charge was lost and the pipe filled with water it appears from Mr. Miller's article that effort was made to free the pipe of water by pouring concrete into it and not by charging it with a large batch suddenly dropped into the hopper. This seems to be borne out by the description of the equipment, which showed a 15-in. delivery pipe feeding the concrete into the tremie hopper. Pouring concrete into the pipe when filled with water would cause a washing of the concrete and a separation of the constituent materials. Also, when the concrete overflowed the hopper it caused a loss of concrete and added to the amount of laitance deposit.

Disadvantages of Large Pipe

The use of a large pipe, 20-in., for example, occasions certain difficulties. It is hard to handle, and trouble is also found in charging such a pipe the first time. Assume that a 1-yd. batch is used. Such a batch would fill about 12½ lin. ft. of a 20-in. pipe. Where the water is deep the surface of this plug of concrete would be at a considerable depth when its lower end emerged from the bottom of the pipe, and the pipe would then have to be dropped very quickly or the plug would leave the pipe entirely and let it refill with water. With a 12-in. pipe the plug would be about 34 ft. long and the time at which the pipe should be dropped could be better judged, since the surface of the concrete plug would be nearer the hopper and more time would be allowed for dropping it. Thus it is seen that so far as charging is concerned, assuming that the concrete is of right consistency, the smaller pipe is less liable to loss of charge and is under better control.

The major part of the laitance deposit on the Toledo work appeared to be due to spilling of concrete and washing of concrete when it emerged from the end of the tremie as it was lifted clear of the concrete previously deposited. Such laitance should form a comparatively small part of the total laitance formed.

The recommendations of Mr. Miller as to the use of several tremies which would not need to be moved horizontally but only vertically and would be under absolute control as to vertical movement should unquestionably be followed where possible. If such a method is used the quantity of laitance will be due mainly to that formed by the upward movement of the excess water in the concrete through the concrete deposited, such water carrying to the surface the very fine material.

Dilution and Sewage Treatment

A GIVEN sum of money can, in general, be spent to the greater sanitary advantage of communities by the purification of water supplies rather than by the treatment of sewage. There are a great many arguments that may be given in support of this statement, but the important ones are so simple and so well known and convincing that there is no need of repeating them here. This statement cannot be taken to exclude sewage treatment altogether, as there are, of course, many cases where large expenditures for this are entirely justified; and it may perhaps be said, too, that there are only a few places where some expenditure for sewage treatment could not be made with advantage. It would seem as though the field of sewage treatment included the prevention of local nuisance and of excessive pollution, but not, if the economic side be considered, the protection of surface-water supplies from small amounts of pollution.

A view now generally accepted looks upon dilution as an entirely reasonable and safe method of disposal so long as the dilution is great enough to prevent local nuisance. Undoubtedly dilution is a great natural resource for the disposal of sewage and other wastes, and there is every reason for making use of it so long as this use does not result in a menace to the public health, or to reasonable standards of cleanliness. Quite a number of the States have undertaken to control these matters, and their policies are generally in line with the reasonable stand that economy must be considered as well as public health and cleanliness. There may be many States where the density of population is not great, in which no special control is likely to be exercised for a long time to come, as there is no particular need of it.

The need of some such control, or at least some understanding between the two Governments, has during the last few years been realized in regard to the pollution of certain of the boundary waters between the United States and Canada. An International Joint Commission has been at work during the last few years making an investigation of the pollution of the Great Lakes and connecting waters with a view to bringing about such an understanding. The commission has made extensive investigations of the bacteriological condition of the boundary waters at various important points and has done much other work that will be of great value in arriving at an understanding.

The question of standards of water purification and sewage treatment came up before the commission some time ago, and the importance of the question was deemed great enough to warrant the commission in seeking the advice of a number of prominent sanitary engineers. A list of questions was submitted to them and considered and discussed at length. As a result a report was presented to the International Joint Commission giving, in the view of these engineers, the most reasonable answers that they could subscribe to for the various questions. This statement is of importance to engineers and others interested in sanitary questions, as it is the most comprehensive and complete statement of general policy on this subject that has been presented on this side of the water, and takes fully into account the economical side of the question as well as the interests of the public health.

There was one dissenter who objected to certain of the paragraphs and who declined to sign the statement so long as those paragraphs were included. The grounds for his objections seemed to be, in substance, that those paragraphs provided for too generous a use of the natural resources of dilution, required too little in the way of sewage treatment where only moderate pollution was involved, and gave substantial weight to the question of reasonable economy. The dissenter appears to belong to the group—among which many members of the medical fraternity are most ardent advocates—who hold the view, with some disregard for economy, that all sewage and wastes should be treated. As an idealistic view this is most excellent, but it is rare that a community, in taking up the consideration of a question of this sort, does not have to give painstaking consideration to the cost. The lack of approval of this one member does not, therefore, lessen the force and value of the statements of the board of sanitary engineers.

The statements are all pertinent and valuable, but certain points expressed or implied appear to be of primary and unusual importance. They can be briefly stated as follows:

1. In general, all surface water to be used for public supply should be purified.

2. A step is taken toward the establishment of a policy intended to prevent the discharge into boundary waters of any sewage without at least a simple treatment, such as sedimentation or screening.

3. The adequate dilution of a sewage is a highly satisfactory means of disposal, and utilizes an important and economical natural resource.

4. The settling of the suspended matters by gravity in suitably designed tanks, or even the efficient screening of the sewage, is recognized as an important fundamental treatment.

5. The propriety of considering reasonable economy in the working out of such problems as these is established.

While the deliberations of the commission refer specifically to matters connected with the pollution of international boundary waters, the statements of the board of engineers may in a large way be applied to all bodies of water where sanitary questions are involved. The statements commend themselves to all who have to deal with questions of public health and public cleanliness.—Engineering Record.

All forms should have ample strength to support properly the loads they are called upon to carry. Loads on forms should be restricted to those for which the forms are designed. These loads should comprise the weight of the concrete and such necessary construction loads as the weight of workmen, runways, wheelbarrows, etc. Storage of construction materials for future use on the forms should not be permitted under any circumstances.

Limitations of Commercial Engineering

IN a broad sense all engineering is commercial in character, but colloquially commercial engineering embraces that branch of the profession which is associated with the marketing of industrial products along technical lines. A striking development has taken place in this field during the last twenty years, and in innumerable instances purchasers of equipment and builders of plants have come to rely upon the advice of commercial engineers in carrying forward their enterprises. The limitations of commercial engineering, however, are often serious handicaps to the fullest success of industrial projects. Seldom have they been so well set forth as in a paper by Andrews Allen upon "Engineering Opportunities in Coal Mining," recently presented before the Western Society of Engineers. The author's conclusions are of general application.

When development or construction work is handled in connection with industrial plants by so-called engineering manufacturers under the supervision of the owner on the "free engineering-service" basis, the combination does not, as a rule, tend toward a broad and comprehensive foresight covering future development or even toward a well-balanced and mechanically efficient installation. In most cases recourse to an independent engineer tends to increase the output and life of the plant, to provide an installation more closely adapted to the requirements as a whole, to insure more economical operation, reduced fixed charges and better satisfaction per dollar expended. Given the required competence, it makes little difference whether the engineer in charge is a salaried employee of the owner or in independent professional practice. The manufacturer is enabled to give better service when he is relieved of general responsibility and can devote himself to doing his work under definite conditions and intelligent direction.

Independent engineering conserves the value of the product by superior preparation and elastic arrangement, taking into account all the elements which make up the plant, through powers of broad analysis and constructive reasoning which the commercial engineer, working in a more limited field, rarely is able to exercise. In much commercial engineering economic waste exists. A manufacturing plant makes its profit by efficient production, and to stay in business it must ultimately establish a selling basis in fair ratio to the cost of its goods. Where such concerns employ a high-priced engineering organization to furnish services for which they are not directly paid, not only is the result essentially unfair—for the customer pays for the engineering expense of from three to ten others—but the manufacturing efficiency of the establishment is often reduced, because so much of the energy of its best men is diverted from the perfection of product and processes. The tendency in such cases to adhere to existing designs, patterns, machine tools and dies militates against well-rounded solutions of the owner's problems.

Plenty of work exists for the engineering departments of manufacturing companies in designing the separate units required by plants and systems, improving such equipment and reducing its cost. When such engineers do general or special engineering work they should make a direct charge for it and thus relieve the manufacturing departments of the burden and play fair with all the concern's customers. Engineers have too long been content to allow their compensation to be covered up in the cost of bill goods, and this is one reason why the profession is so frequently underpaid and unrecognized. Wherever special designs have to be made, where the installation involves the assembly of numerous elements to furnish which the manufacturer would, in fact, be a jobber, or wherever the installation requires careful examination and analysis of conditions and elaborate study of plans, the best results can be secured by an independent engineer directly in the pay of the owner. On the other hand, where a machine, using the word in a broad sense, is manufactured complete by an engineering organization, and where its duties are so definitely known that they can be made subject to definite guarantees under prescribed conditions, and where the engineering work is primarily an adaptation of standards, the design may safely be made by the manufacturer, though even here the independent engineer can be of great help to the owner.

The independent engineer has the best possible opportunity to design his work so as to confine competition within the limits of the plans and specifications. Where competitive general designs are made by manufacturing companies, conscientious firms frequently lose out to those who skin down the requirements and build only just well enough to secure their pay. Where an installation planned by an engineering manufacturer seems to cost less it is usually because less attention has been paid to operating efficiency, maintenance and future requirements. A dollar spent in the beginning is frequently worth ten dollars afterward. If an owner attempts to obtain the advantages of competition without complete plans and specifications, asking manufacturers to prepare their own plans on the basis of general requirements only, the result is usually bewildering. Few bidders are willing to gamble to the extent of making thorough studies and complete designs and the result is a lot of half-baked plans and prices with liberal allowance for uncertainties. Even in cases where the manufacturer is given a free hand and specifically paid for engineering development work in the absence of full plans prepared by the owner or his engineer there is little certainty that the latter will obtain what he most needs. Complications over responsibility often arise, and in such cases the commercial engineer cannot serve the owner with anything like the efficiency of the consulting or staff expert, who in the long run is the best reliance of the investor in matters of broad technical importance.—Engineering Record.

Examination of Concrete Failures for their Determinating Causes

A paper on the above subject read by R. S. Greenman at the recent annual meeting of the American Society for Testing Materials, states that concrete is said to be its own best inspector, and it is a well-known fact that defects in concrete will sooner or later make their presence known.

The reasons for poor concrete have been proportioned as being 90 per cent due to poor workmanship, 8 per cent. due to poor aggregates, and 2 per cent. due to poor cement. These reasons and the additional one of the influence of the water used, are responsible for most of the failures in concrete. These failures are more frequent in smaller than in larger work and the resulting losses are proportionately greater.

To find a reason one must examine all possible causes and must follow up all clues that tend toward disclosing the reason. The design, the quality and proportions of the materials used, the mixing and placing and the care of the finished concrete must all be considered. In making an examination, each case must be treated entirely upon its own individuality; and the right clue will not be found unless the investigator knows good and poor concrete and knows why certain things produce certain results in concrete.

In trying to solve a problem of poor concrete the elements to be investigated are cement, aggregates, workmanship—and water. The common tendency is first to place the blame upon the cement, but if it is found that, in accordance with good and generally common practice, the cement has been tested and has met the standard requirements, the cement then becomes a negligible factor; but if it has not been tested, it must be considered as a possible cause, and it may become a large item in the study. It must be admitted that since so much stress has been laid upon the value of having cement tested before use, and since it must indeed be a small work on which it has not been so tested, the percentage of failures due to poor cement has been reduced to a very small amount.

The strong and weak points in both the coarse and fine aggregates have been too often neglected. The coarse aggregates can usually be judged by easy inspections, but sand or other fine aggregates need very careful examination. Their characteristics—such as the grain, the grading, the cleanness and freedom from organic impurities and excess of loam are items of knowledge which are obtainable mainly in the laboratory, but which are very essential for the correct diagnosis of a concrete failure.

The effect of workmanship is by far the largest factor and in it all others are included, for a poor workman can destroy the value of the best materials. Under the head of workmanship must be considered such items as design, proportions, placing, and actions resulting from heat frost, electrolysis, etc., which should have been taken care of in the process of making, hardening and preservation.

As another element of importance, it must always be kept in mind that the water which is used in making the concrete, or which may come in contact with it, may prove to be a very influential factor for harmful results.

To illustrate the possibilities of various influences, specific cases are cited showing effects of certain elements upon water, sand and stone and the resulting effects upon the concrete. The effects of poor workmanship are seen in various conditions found in concrete. To find these effects it is also necessary that the investigator shall know how to grasp and to follow up the first indications of there having been anything wrong.

Some external influences also cause concrete to fail and the possible relation of these to concrete failures must be considered. For many years all the failures of concrete were considered as being due to the formation of certain chemical relations; but as it is commonly acknowledged at present that an impermeable concrete will stand in sea water as well as elsewhere, although subjected frequently to more severe actions than other concrete, its failures are due frequently to the same causes as those of other concretes and therefore the same examinations should give the same results. Similarly, since electrolysis is considered as a cause for the breaking down of concrete, the liability of concrete being affected by its influence will depend upon whether or not the concrete comes under the influence of an electric current. If it does, then its influence needs to be examined. If it does not, then the axamination should also follow the usual method.

The value of laboratory tests and analyses should not be overlooked. While perhaps not giving such definite information as a field inspection, they should be used to the fullest extent to help establish the strength or weakness of a reasonable theory for the cause of failure. Where time will permit, laboratory tests of concrete made of the aggregates under as nearly as possible the same conditions, will give results that should aid in determining the fault in the original. Test specimens so made and treated should give practically the same results, and when compared with test specimens made under ideal conditions or with standard materials, should give the investigator the reasons for the failure.

All means possible should be used by an investigator in making his examination, and his conclusions must be drawn only after he has considered the failure from every probable cause, with reason and fairness. The object of the examination is either to place responsibility or to guard against future failures, and right conclusions are the only ones that should be drawn if justice to either objective is to be given.

Architectural Terra Cotta

THERE is no older manufactured material known to man, but it is only in comparatively recent years that burned clay, in the perfected form of architectural terra cotta, has come into great prominence as a building material. The favor which it now finds among architects and builders is due in part to certain remarkable qualities which were long latent and undiscovered and which the demands of modern construction have brought to light; and in part to new qualities which have been added as a result of scientific investigation and experimentation with terra cotta in an effort to develop its full possibilities. Because of these unusual natural and acquired qualities and attributes, there is at present available to architects no material which merits more careful attention and consideration than architectural terra cotta. It is without doubt the ideal building material of the twentieth century.

Architectural terra cotta deserves the marked recognition which it is now receiving, first of all, because it is durable. The figurines of Tanagra and the water-jars of Egypt are in practically as good condition to-day as they were when made, thousands of years ago. Architectural terra cotta never wears out. There is, in fact, nothing about it that can wear out. It is as permanent as earth because it is earth. To the two forces that work most potently for the destruction of a building material, that is, fire and water, architectural terra cotta offers the most stubborn and successful resistance. It is manufactured under a terrific heat, more terrific than that of any conflagration. The appalling disasters at Baltimore and San Francisco proved that those buildings in which the structural materials are protected by architectural terra cotta and brick can most successfully withstand the ravages of fire. By water, the other of the two foes of permanence in a building material, architectural terra cotta is totally unaffected. In the case of many materials, water finds its way through the surface, freezes, causes expansion and ultimate disintegration. In the case of architectural terra cotta, this destructive process cannot even begin, because the first step, the penetration of water beneath the surface, is impossible, inasmuch as architectural terra cotta is impervious to moisture.

Architectural terra cotta is further excellently adapted to modern building construction because it is at once strong and light. Ordinarily, these two qualities are inconsistent: the material that is strong is heavy; and that which is light is weak and of uncertain resistance. The modern skyscraper demands a material so strong that it can be used with safety under the most exacting requirements, and so light that the cost of foundations, superstructure, and installation may be reduced to a minimum. Architectural terra cotta is just such a material, and its use for the entire facing of the largest business buildings in the world is an evidence that wide recognition is being given to its unique qualities.

Every architect to-day is alive to the demands of beauty and attractiveness. Even in buildings designed for the most utilitarian purpose—in factories, for example—there is a strong demand that the aesthetic sense be satisfied. Architectural terra cotta, because of its infinite possibilities as regards form, may be modelled to express the most delicate beauty and charm. It can be made in many tints and colors and in limitless combinations of colors. And, what is equally important, it retains all of its original qualities. Dirt, smoke and soot do not permanently discolor its surface; they do no damage that cannot be easily undone by the application to the terra cotta of ordinary soap and water.

Architectural terra cotta, while it possesses these remarkable qualities, offers unusual opportunity for economy. This material makes it possible for the finest ornament to be used in buildings intended for the most practical purposes, at a most reasonable cost. For years, fine ornament was divorced from modern utilitarian architecture because it could be secured only by the slow process of individual hand carving. By fine ornament is not meant the disgusting amount of cheap, machine-made ornaments that disfigure rather than embellish, but those legitimate forms that have had the endorsement of all ages. When the cost of hand carving became prohibitive, these had to be abandoned. Now by the use of architectural terra cotta—by making a plaster mold of one piece and pressing many pieces from the same mold—the sculptor's model for cornice, pediment, or frieze can be duplicated at relatively low cost. This process of repetition is such a decided saving that it makes feasible the employment of the best available talent for the creation of the original model. As a result, the most pleasing effects can be introduced without waste and with the utmost economy.

Consider the practical advantages that result from the use of a material with these extraordinary qualities. Because of its lightness of weight, it is easily and inexpensively handled and put in place; and because of this same lightness, it makes possible a substantial saving in connection with the entire structure. Once placed in position, it is durable for all time. It cannot melt, disintegrate, or decay. It can, moreover, in the first instance, be made unusually attractive and beautiful by the use of a great variety of surface finishes or of one or more colors, and this original beauty is permanently retained. It is fire-proof, waterproof, dirt-proof and time-proof. It is, in short, all that could be demanded by the most exacting and discriminating in the way of an ideal material for use in the buildings of the twentieth century.

The Selection of Asphaltic Materials for Road Construction

THE fundamental requirements of asphaltic materials are discussed in a concise and interesting manner in the following paper, which is a prize essay submitted by A. A. Berkowitz in a recent competition held by the Barber Asphalt Company.

To specify an asphalt by its chemical or its physical properties alone is not enough. The chemical properties of two asphalts might be the same, while physically they differed markedly. Moreover, a relationship exists among certain properties, and there is danger of assigning limitations to the several properties covered in a given specification without considering the effect of each limitation upon the other properties included. For instance, the higher the ductility required of an asphalt the more susceptible it is to change in temperature. Furthermore, the engineer cannot be governed entirely by theoretical considerations, but must keep in mind the ability of the manufacturers to meet his requirements. He should avoid making requirements that are superfluous, inconsistent, unnecessarily increase the cost, or sometimes even impossible to carry out. Numerous instances can be cited where the combinations of properties required have not existed in any commercial material. These impossible requirements usually result when the engineer selects clauses here and there from several other specifications which he knows to have given satisfaction. With a view toward remedying this evil, the American Society of Civil Engineers, the American Society for Testing Materials, etc., have prepared standard specifications for asphaltic materials in various kinds of road construction. These specifications are very well drawn up and serve their purpose admirably, provided they are correctly and intelligently used. It is in this regard that experience can help us. In cases where these specifications have been used, nearly all the failures have been due to the fact that the specifications were followed blindly, without an understanding of their value and their interpretation; merely, as it were, substituting in a formula without considering the units involved. A knowledge of the value and interpretation of each test must be possessed by every engineer who makes or who uses specifications before he can hope to obtain success in the employment of these very desirable materials. This is, in fact, the chief lesson of experience. Then, knowing these facts, and keeping in mind the lessons of service tests of similar materials under similar conditions, the engineer can employ specifications with the assurance that his work will be a success.

The value and interpretation of the more important tests required of asphaltic materials will be discussed. The method of actually making these tests will not be taken up, since these can better be obtained from the aforementioned standard specifications.

The individual tests usually specified may be divided into three groups: (1) They may directly indicate the suitability of the material specified for a given use; (2) they may serve as a means of identifying the material or its source, and (3) they may serve to control uniformity in the preparation or manufacture of a material.

Viscosity.—The most important test belonging to the first group is the determination of the consistency or viscosity. The consistency or viscosity of a material is its degree of firmness as determined by measuring its internal friction. Requiring this test in the specifications is of value since a physical test can generally be better understood than any corresponding chemical one. This test, however, can be of maximum value only when applied to a specific type of asphaltic material and when considered in connection with other tests, which by themselves may not directly indicate suitability. Thus for one type of bituminous concrete pavement the proper penetration at 25 deg. C. for a California asphalt may be between 7 and 9 mm., while the proper penetration limits for a fluxed Bermudez asphalt, to be used in exactly the same type of pavement and under the same conditions, may be from 14 to 16 mm. Again, experience has shown that a harder asphalt cement is needed for a sheet asphalt pavement of sand, powdered limestone, and asphalt cement, than for a pavement containing crushed stone. The amount of traffic and the climate are also important factors to be considered in fixing penetration limits for any asphaltic material.

Volatilization.—Another test serving to indicate the suitability of a material for any special purpose is the volatilization test. A determination is made of the loss in weight of the material by volatilization, and of the consistency of the residue. It is of considerable value when applied to road oils. The loss in weight thus found is a fair indication of the loss by volatilization suffered by the material in the course of time when applied to the road, and also the character of the residue is similar to that eventually left in the road. The residue should be of a sticky nature. If the residue of these oils are not sticky and adhesive they will produce an undesirable surface in wet weather. A paraffin oil will produce a greasy residue, and is consequently worthless for road work, whereas an asphaltic oil may be successfully used for this purpose.

Identification Tests.—The more important tests serving as a means of identifying the source of a material or even the material itself, are the specific gravity, melting point, solubility, in carbon disulphide, and fixed carbon determinations. The specific gravity of an asphaltic material is one of the most important characteristics used to determine its identity. This is especially true if its specific gravity is considered in connection with the consistency of the material, and sometimes its solubility in carbon disulphide. Thus a bituminous material with a specific gravity of 0.99 and a penetration of 7 mm. at 25 deg. C. is a blown product. Fluid consistency and a high specific gravity of 1.25 in a tar serves to identify it as a coal tar, and the identity is strengthened if its solubility in carbon disulphide is as low as 75 per cent. As applied to oil and oil products, the specific gravity roughly indicates the amount .of heavy hydro-carbons which give body to the material. As a rule, paraffin oils have the lowest specific gravity and are of no value for road work, whereas asphaltic oils have the highest specific gravity and are most desirable for this purpose. In regard to solid bitumens as originally found, it must be remembered that the specific gravity will depend largely upon the per cent of mineral matter. Thus the specific gravity of Trinidad asphalt (containing 37 per cent of mineral matter is 1.40, while Gilsonite, an extremepure native bitumen, has specific gravity of 1.04.

The melting point of a bitumen is directly related to its hardness and brittlemess, but the relations for all clasess are not the same. The method of employing the material must also be considered in connection with its melting point. If the penetration method is used, the melting point should not be too high, because the highly heated material would be solidified by the cold stone before it had penetrated to any extent. In a bituminous concrete pavement, the melting point may be as high as climatic conditions will allow.

The determination of the solubility in carbon disulphide of an asphaltic material enables the amount and character of the contained bitumen to be ascertained. The percentage of bitumen thus obtained does not alone determine the value of an asphalt for paving purposes. Two asphalts might contain the same amounts of bitumen and yet possess entirely different powers of resistance to the destructive action of the elements. One might possess stability, the other not. The character of the bitumen does, however, indicate, by the amount of mineral matter present, whether an asphalt has has been used. Likewise, an absence of mineral matter indicates that the material has been destructively distilled during its preparation.

The amount of fixed carbon in asphaltic material also serves to identify the source of a material. Thus high fixed carbon in most asphaltic cements produced from Mexican petroleums serves to differentiate them from asphalt cements of the same consistency produced from California petroleums. Consequently, if the amount of fixed carbon found in a California asphalt cement were as high as the amount usually present in Mexican asphalts (about 16 per cent.), the indication would be that it has been injured by overheating.

Method of Manufacture Tests.—The tests that serve to control the preparation and manufacture of a bituminous material are the flash point, distillation, and the solubility in naphtha tests. The temperature at which the material flashes is an indication of the treatment to which it has been subjected. Crude oils have a low flash point, while more highly distilled products have correspondingly higher flash points. The flash point of a material must be considered in connection with its proposed use. If the material, especially a heavy road oil, is to be heated before application, the flash point should be high enough to prevent its ignition while being heated.

The distillation test is a valuable one, indication of the amount of body-forming hydro-carbons which give mechanical stability to the material. No oil containing less than four per cent. of bitumen insoluble in naphtha will prove of service other than as a dust preventative.

Service Tests.—To the valuable data that may be obtained in the manner described above must be added the lessons of experience and service tests of various conditions and in different types of roads and pavements.

The need of alleviating the dust nuisance has involved the use of asphaltic oils for that purpose. Experience has shown that the oils used should show some degree of adhesiveness when rubbed between the fingers. Their residues after the evaporation test should be decidedly sticky. If oily, they will act more as lubricants than as dust binders.

It must be emphasized again that paraffin oils are worthless for this purpose. Engineers throughout the country are finding that the use of palliatives for dust prevention is but a makeshift at the most, and that the best practice is tending toward the construction of bituminous surfaces or carpet coats wherever any degree of satisfaction and permanency is desired.

Bituminous surfaces are used principally on macadam and gravel roads, on bituminous and cement concrete pavements, and to some extent on brick and stone pavements. The character of the traffic to which the road is to be subjected should be considered in the construction of a surface. Experience has shown that if the road is subjected to light motor and light team traffic only, with the motor vehicles predominating, an asphaltic oil of such viscosity that it requires heating to at least 250 deg. F. before application forms a bituminous surface that withstands the traffic and thoroughly preserves the road for a period of time depending upon the quality of the material and workmanship and upon the quantity of traffic. The failure of many bituminous surfaces can be traced to improper preparation of the broken stone surface. The adhesion of the oils to the stone is a very essential point to consider. Most engineers are in favor of applying the bituminous material under pressure since the adhesion to the stone is much more satisfactory in this case. In order to get the best adhesion of asphaltic oils, the stone surface should be a little moist rather than extremely dry, but in either case, every particle of dust and dirt should be removed from the stone by sweeping. With proper construction and under normal traffic conditions, retreatment is necessary every one or two years. In choosing the bituminous material for a surface which will have to be renewed often, experience has shown that care must be taken to select a material which will set up sufficiently to allow the application of repeated layers without producing a plastic, easily moved blanket surface. Properly constructed, bituminous surfaces are quiet, practically dustless, and comfortable to use.

With the advent of the motor car, it was found that the water-bound macadam pavement did not stand the automobile traffic and that bituminous macadam could be laid to withstand this traffic at a cost equal to water-bound macadam, when the maintenance of the latter is considered. The bituminous material used may be either asphaltic cement or refined coal tar. The former is preferable because it possesses greater stability under atmospheric action. Here again, numerous instances can be found where unsuitable materials have been employed through the failure of the engineer to understand the physical and chemical properties of the different types of asphaltic materials, and the different methods of treating them. For example, many a good asphalt has been ruined by overheating. Again, asphalts of too little ductility have been chosen. The slight displacement of the mineral aggregate of a pavement due to the shocks of hoofs or wheels makes it necessary that the asphalt cementing material should yield and stretch a little and not break. On the other hand, the greater the ductility, the more susceptible is the asphaltic material to changes in temperature. Once more the knowledge of the relationship among the various properties of a material enables the engineer to intelligently set the limits in his specifications.

A series of experimental sections was constructed on a road subjected to mixed traffic of about 100 horse drawn vehicles and from 250 to 300 motor cars per day. These sections were constructed with asphalt, refined water gas and coal tars, and combinations of refined coal tars and asphalts, in the form of bituminous concrete pavements, using the same material for the cement and the seal coat. Upon examination after three years, it was found that for this class of traffic, or for horse drawn traffic exclusively, the seal coat should consist of an asphalt, as being more durable and economical than the other materials. Experience in another locality has shown that an excess of flux or of the volatile constituents in asphalt cements has been a cause of failure. Pavements constructed with such materials are wavy and distorted by heavy traffic.

Sheet Asphalt

One of the most widely used pavements is sheet asphalt. Trinidad asphalt was for many years the only available supply of such material, but in recent times many other sources have been disclosed. In addition to the native asphalts, like those obtained from Trinidad and Bermudez, asphalts are obtained by refining asphaltic oils. The results of experience and service tests in this kind of pavement alone furnish the engineer with a collection of valuable data. The selection of both the aggregate and the asphalt cement requires a careful understanding of the climate, traffic and other conditions. Proper drainage, in this, as in all other pavements, is a primary requisite. Furthermore, certain bitumens require more skill in handling than others. Again, some require particular fluxing agents and result in failures when improper ones are used. The main requisite of a good sheet asphalt pavement is inherent stability. This can only be obtained if the mineral aggregate is properly selected and if the bitumen possesses cementing value. Experience has shown that the heavier the traffic to which the pavement will be subjected, the finer must be the particles composing the mineral aggregate. In addition, the consistency of the asphalt cement must be of the right degree, that is, the newly laid pavement should not be too hard. The marking up of a pavement by the caulks on horses' shoes does not necessarily indicate that the pavement has been improperly constructed. If the pavement were too hard at the start it would have a shorter life than if a softer asphalt cement had been used. Sheet asphalt pavements properly constructed with native asphalts, either from Trinidad or Bermudez, have given the highest degree of satisfaction. The Barber Asphalt Paving Company recently took a census of the old asphalt pavements. In New York City there are 184,290 sq. yds. of Trinidad sheet asphalt 20 years old or older. A part of this is on Fifth Avenue and is subjected to the very heaviest traffic. The remainder is also subjected to heavy travel, yet all the pavements are in very good condition at the present time. Washington, D.C., has more than 1,000,000 sq. yds. of Trinidad sheet asphalt pavement laid between 1877 and 1901. The average cost of maintenance is 1.8c per square yard per year.

Notes on the Causes of Failure of Stucco Work

NOT many years ago stucco was quite generally used in certain localities, but owing to failures of the material to withstand the action of the elements and to other causes, this type of construction was almost entirely abandoned, says a writer in Cement and Engineering News. During the last few years, however, there has been a very marked tendency by the building public to take up this class of construction again; therefore this word of caution.

We do not want to have the same experience with this class of work as the concrete block industry has had, and yet, unless due care is used in drawing specifications and in their application, there are going to be a great many failures as in the past. Our architectural friends are very partial to stucco exterior, and if it is properly mixed and applied, will come up to their expectations in every way. So much depends on the selection of the material, proper mixing and proper application that only skilled mechanics who are familiar with this class of work should be employed.

I remember one residence in particular, where there were a great many horizontal cracks in the stucco running almost the entire length of one side of the building. These cracks were about two feet apart and were very pronounced. The whole area of sides and ends was very unsightly. After a careful investigation it was found that in nearly every instance where cracks had developed, they were at a point where the wire lath was lapped, and in many places less than one-quarter inch thickness of stucco was over these laps. In some instances by cutting out the cracks it was found that the metal lath was not even tacked solidly in place, and yet stucco work in general was condemned by a number of parties on the results obtained in this one building. It was quite apparent that the trouble was not due to any fault of the material, but in this particular instance was entirely due to the application of the wire lath and stucco. In addition to the large cracks at the laps of the wire lath, there were a number of hair cracks throughout the entire area, which apparently were caused by too much trowelling of the concrete mass, and as was found by investigation there was a coating or frosting of Portland cement on some of the areas and the cracks penetrated just through this frosting. Other areas were entirely smooth and cracks had not developed.

In another case regular lime mortar plaster without any Portland cement was used for the scratch coat. The first coat consisted of regular interior plaster and the second coat consisted of Portland cement, asbestos rock and asbestos fibre. The second coat was very thin and the damp salt air and moisture penetrated through to the first coat. The lath became swollen and the stucco came off in sheets. The stucco on this work was condemned and the faults were laid at the door of the asbestos and Portland cement. Upon investigating the matter thoroughly, it was readily shown that the entire trouble was due to the nature of the lath and the materials entering into the first coat.

I have referred to these buildings with a view of cautioning people interested in stucco construction to see that this particular part of the building is given proper attention. In the past stucco has been applied in two coats, the total thickness being about one-half inch to five-eighths inch. Past experience is teaching us, however, that one inch is by far better, and if the the material is applied in this thickness house owners and architects should not have reason to regret its use.

To Obtain a Uniform Color

Another point of considerable importance is the color. A uniform color is rather difficult to obtain, on smooth surfaces particularly, but it can be obtained if proper attention is given to the selection and mixing of the ingredients and if the stucco is properly applied. When Portland cement and sand are used, it is very essential that the sand should be absolutely free from any organic materials which have a tendency to discolor. It is also of vast importance that the ingredients be mixed very accurately and carefully and that a sufficient amount be mixed at one time to cover certain areas exposed to the same lights and shadows.

For example, the work should not be left in an uncompleted condition half way between windows or half way down the side walls, for just as surely as this is done, there will be a streak showing where the latter work was started. If it is necessary to do a certain given area at two operations, care should be used to get the materials properly blended and the new stucco floated or trowelled to correspond exactly to that already done. By using a little care on details of this kind the ultimate results will be much more satisfactory.

Improper Mixing

Portland cement and sand as a stucco mixture has been used with fair success where work has been carefully supervised, but there has been such a lack of proper attention to the mixing and application that there have been some bad failures. The use of asbestos rock and fibre to take the place of sand is meeting with considerable success. The asbestos fibres have a tendency to hold the water which is used to mix the concrete mass, longer, thus giving the Portland cement ample opportunity to become properly set, and in this way stucco mixtures are possible that are more uniform in color and less liable to crack, as the fibre also furnishes additional bond.

There is one point which is frequently lost sight of; that is, it is possible to manufacture or make concrete slabs that are free from cracks and that can be exposed to the elements for an indefinite period without discoloration. Therefore, should cracks develop in a well-constructed stucco work it can be invariably traced to settling of the building or the shrinking of the frame. By insisting upon thicker stucco walls the liability of the stucco's cracking is reduced to a minimum.

The price of lumber is readily advancing and the desire for fireproof exteriors, especially in the suburban districts, as well as artistic effects that may be obtained from stucco, are creating a universal demand for this type of construction, and, while the initial cost may be slightly more, it is such a small part of the total outlay and such an important part of the structure that the best is the cheapest in the end.

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

Hamilton ratepayers have defeated a bylaw to spend $175,000 on the construction of a sewerage system.

The Montreal General Contractors' Association have new permanent offices at Victoria Building, Victoria Square.

Tenders have just been taken by the architects (Messrs. Audet & Charbonneau, of Montreal) for an apartment house estimated to cost $275,000, to be erected at Westmount, Que.

The new school building which is being erected at Quebec by the R. C. School Commissioners at a cost of $200,000, is nearing completion. The architect is Mr. R. P. Lemay and the general contractors Messrs. Jinchereau & Lalonde, Quebec.

Constructional operations at the west end disposal plant which is now being erected for the city of Hamilton, are progressing satisfactorily, according to the City Engineer, Mr. A. F. Macallum. It is expected that the plant will be ready for service by November.

Plans are in preparation by Mr. J. H. McDowell, a local architect, for a new theatre estimated to cost $200,000, to be erected at the corner of St. Catherines and Mountain streets, Montreal. Mr. Maurice Wolff, of Montreal, is among those interested in the project.

Excavation is in progress for an apartment house, estimated to cost $100,000, to be erected at Bay and Herkimer Streets, Hamilton. The building will be 125 ft. by 65 ft. in dimensions, six storeys high, of fireproof construction. The architects are Messrs. Stewart & Witton.

The season's operations in road work in Northern Ontario are practically at an end. Excellent progress has been made and the total expended has reached $850,000. The work has been carried out under the direction of the Government Commissioner, Mr. J. F. Whitson.

Tenders are about to be called for a $200,000 club house which the National Amateur Athletic Association propose to erect at Montreal. The new building will be 4½ storeys high, 110 feet by 106 feet in dimensions. The architects are Messrs. J. A. Ouellet and J. O. Turgeon, both of Montreal.

Foundation work on the Earnscliffe Apartments has been started at Toronto. The new building, which is estimated to cost $500,000, will be eight storeys high, of steel and brick construction. The architect is Mr. N. G. Beggs, and the general contractors are Messrs. Deeth & Son, Toronto.

Preliminary arrangements have been completed for the construction of a large office building and garage for the Automobile Club of Canada, Montreal. The provisional plans are for a ten-storey building. The time of commencing operations depends to some extent upon the course of the European war.

A gratifying statement covering the first year of operation to June 30, 1914, has been issued by the Ontario Steel Products Company, Limited. The net profits are over $106,000. These have been determined for the year after providing for depreciation of properties and the entire cost of organization.

Good progress has been made in the erection of the six-storey, reinforced concrete factory building which the Ford Motor Company are building at Toronto. The walls are now up five floors and operations are continuing. The general contractors are Messrs. F. J. Mark Construction Company, Birmingham, Ala.

An addition estimated to cost $300,000 is to be built at the Ford Motor Company's plant at Ford City, Ont. The new building will be 200 feet square, six storeys high, of reinforced concrete construction. The company is now building assembling factories in Toronto and Montreal, and they expect to start another in London, Ont., by the fall.

A start has been made on the office building which is to be erected at the corner of Adelaide and Toronto streets, by the Excelsior Life Association, at a cost of $500,000. The structure will be eleven storeys high, of steel, terra cotta, and brick construction. The architect is Mr. E. J. Lennox, and the general contractors are the P. Lyall Construction Company.

The foundation work for the Assembly Hall which St. Patrick's Parish propose to erect at Montreal has been completed. The general contractors on the new building are Messrs. John Quinlan & Company. The type of construction will be reinforced concrete and steel, and the estimated cost is $135,000. Mr. J. P. Hynes, of Montreal, is the architect.

Plans have been completed for the dry dock and shipping plant which it is proposed to build at Owen Sound at a cost of $1,500,000. The promoter of the project is Mr. F. F. Wood, and the architect and engineer is Mr. E. D. Pitt, both of Niagara Falls, Ont. Major Gillette, of Philadelphia, is the consulting engineer. The proposed dock will be 775 feet long and 104 feet wide, with a depth of 21 feet.

The City Engineer of Montreal, Mr. George Janin, has submitted to the Board of Control the report of the experts appointed some time ago to examine the conduit. The report states that the construction of a second conduit is not necessary. The sum of $25,000 is said to be required for repair work on the present conduit. It is expected that the enlargement of the aqueduct will be finished within two years.

The exterior structure of the new post office now under construction at Quebec, at a cost of $400,000, has been completed. The building is to be six storeys high and the materials entering into its construction are Deschambault stone, marble, terra cotta, hollow tile, reinforced concrete, and steel. All the most modern equipment will be installed. The accessories include ventilators, fire escapes, iron railings and stairs, revolving doors, mail chutes, telephone system, sprinklers and motors.

The harbor development work at Toronto is to be carried on in accordance with the plans laid out at the beginning of the season, according to a statement made by the Secretary, Mr. A. C. Lewis. This year the Harbor Board will spend approximately $1,400,000 on reclamation work, piledriving, piers, and the excavation of the ship canal in Ashbridge's Bay. About one thousand men are employed on the works. Half of these are in the employ of the Commission. The rest are engaged by the contractors.

The ratepayers of St. Catharines, Ont., have carried a by-law to construct a high level bridge across the old Welland canal from the main section of the city at Shipman's Gore to Western Hill, where the G. T. R. main line, Niagara Falls to Sarnia, is situated. The viaduct steel structure, with approaches, will be constructed at an estimated cost of $220,000. The project has been under discussion for over a quarter of a century, and the other proposed routes have been previously voted down. The new bridge will connect the main automobile road between Buffalo and Toronto on the west side of the old canal, with the main business street of the city.

WESTERN CANADA

At Dauntless, Alta., excavating has commenced for the $750,000 factory which is to be erected by the Dominion Harvester Company.

At Regina, Sask., the Parsons Construction and Engineering Company have obtained a contract for a power house, six residences, and other work in connection with the provincial gaol.

The drill hall which is being erected at Winnipeg for the Dominion Government, at a cost of some $500,000, has reached the roofing stage. Excellent progress has been made by the general contractors, Messrs. Carter-Halls & Aldinger, of Winnipeg.

Steel work has been completed on the Grain Exchange building which is being erected at Winnipeg by the Traders Building Association at a cost of $500,000. The building will be of brick, stone and steel construction. Messrs. Jordan & Over, Winnipeg, are the architects and Messrs. Carter-Halls & Aldinger the general contractors.

At Calgary, operations have commenced on the erection of a new building for the Merchants Bank of Canada. The new bank, which is being completed this year, is three storeys high, of steel and brick construction, with Bedford stone and granite front. The architects are Messrs. Brown & Vallance, and the general contractors are Messrs. Carter-Halls & Aldinger Company, Winnipeg.

At Edmonton, Alta., excavating has started on the offices and apartments which are to be erected at the corner of Jasper and 16th Streets by Hugh McPhee at a cost of $100,000. The building is to be four storeys high, of reinforced concrete, steel and brick construction. The architect is Mr. E. W. Moorehouse, and the general contractors are Messrs. Nesbitt & Miller, both of Edmonton.

Foundation work has been started on the new central school which is to be erected at North Vancouver, B.C., at a cost of $120,000. Contracts for the actual building have not yet been awarded. The new school will have two storeys and basement and will be of reinforced concrete, tile, and brick construction. The architect is Mr. W. C. Gillam, and the general contractors are Messrs. W. J. Smith, Limited, both local firms.

Estimates for work completed on the Greater Winnipeg Water District railway, diversion dike, and other parts of the undertaking were passed last week, the total amount involved being about $200,000. Chief among the items were $61,000 for steel rails to the Algoma Steel Corporation; $45,000 for railway construction to the Northern Construction Company; $48,000 to O'Brien & McDougall for ties. The district has now secured 74 per cent. of the ties needed, and 55 per cent. of the steel rails. Of the telephone line 71 miles are now complete, and on the railway construction 36 per cent. of the excavation is done, and 20 per cent. of the total of 94 miles of track laid, while 71 per cent. of the railway splice bars are already delivered. Up to July 25 grading had been completed on 40 per cent. of the line, and 20 per cent. had been ballasted. The whole of the right of way for the railway and aqueduct has been cleared, thus completing that part of the work involving the clearing of 2,583 acres. The district has purchased 14,467 fence posts. At Deacon the reservoir site, the contract for the boring of the well has been about completed, and the well now being finished is capable of delivering 40,000 gallons a day. On the Falcon River Diversion dike, the contractors drew an estimate of $13,000 for work done, the part of the whole dike completed being 36 per cent.

At Newton, Ont., a contractor named Davidson fell from a scaffold last week and succumbed to his injuries.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Berlin, Ont.

Plans are being prepared for the installation of a sewage filtration plant. The engineer in charge is Mr. S. Shupe.

Calgary, Alta.

The ratepayers have passed a by-law authorizing the expenditure of $80,000 on extensions to the waterworks.

By their vote on the by-law recently submitted, the ratepayers refused to sanction the expenditure of $98,000 on the construction of the 4th street subway.

Downie Twp., Ont.

Tenders will be received by the township clerk, Mr. Peter Smith, of Stratford, until August 31st, for the construction of the Ballantyne drain. Specifications may be seen at 55 Elizabeth street, Stratford.

Empress, Alta.

The installation of a waterworks system is being considered by the town council. The John Galt Engineering Company, of Calgary, has submitted the following estimate for the work. Power plant, $16,000; reservoir, $6,000; 10-inch watermain from the reservoir to the town, $33,000; distributing system, $11,000. The total cost of the project is placed at $64,000.

Hamilton, Ont.

The by-law calling for the expenditure of $175,000 on the construction of a sewerage system for the east end of the town was defeated by the ratepayers on the 17th instant.

London, Ont.

Plans are being prepared by the city council for the construction of a sewer plant on Egerton street. The estimated cost is $75,000. Mr. Willis Chapman, of the Mail Building, Toronto, is the architect.

Ottawa, Ont.

The city council proposes to lay wood block pavement on Anglesea street between Chapel and Augusta streets.

The city council proposes to construct wood block pavement on York street between Friel and Chapel streets.

The construction of wood block pavement on McGhee street, between St. Patrick and Water streets, is being considered by the city council.

Tenders will be received by the city council until August 27th, for the construction of pavements. The quantities are approximately, asphalt, 32,976 sq. yds.; waterable, 9,808 sq. ft.; gutter, 13,566 lin. ft.; and curb and gutter, 4,676 lin. ft. Plans and specifications are with the engineer, Mr. F. C. Askwith.

Point Grey, B.C.

Plans have been prepared by the municipal council for the construction of sewers on the east end of Alma Road.

Port Moody, B.C.

Tenders will be received by Mr. W. P. Mackay, chairman of the municipal council, until 5 p.m., August 31st, for the supply of the following material: Steel pipe, 2,046 lin. ft. 12-in.; 9,412 lin. ft. 10-in.; 13,189 lin. ft. 8-in.; 2,290 lin. ft. 6-in.; 33 gate valves, 43 fire hydrants, and 10,000 special castings. Specifications are at the office of the engineers, Messrs. Duncan & Leslie, 502 Duncan Building, Vancouver.

Prince Rupert, B.C.

Plans are being prepared by the city council for the construction of a reservoir to be situated above the Thulmer River falls. The capacity is to be 255,000,000 cubic feet. Electrical energy is to be developed.

Revelstoke, B.C.

The Warren Construction Company, of Victoria, have been asked to submit an estimate for the construction of bitulithic pavement and sidewalk on Government street between the High and Central schools.

Toronto, Ont.

Tenders will close with the Board of Control on Sept. 1st, for the construction of sewers on nine streets, also the West Toronto sewer system No. 2 division outlet. Plans are at the office of the Works Department, City Hall.

Tenders will be received by the Board of Control until September 2nd for the construction of asphalt pavements on 11 streets, rocmac pavements on 3 streets and concrete walks on 8 streets.

The following bids for the additions and alterations to the high level pumping station have been received and referred to the commissioner of works for his report. $41,865, $38,250, $46,670, $38,513, and $36,000.

CONTRACTS AWARDED

Chatham, Ont.

The city council has awarded to the Carritte Paterson Company, of St. John, N.B., the contract for the construction of about 6,000 yds. tarvia pavement.

London, Ont.

The city council has awarded to the J. H. McKnight Construction Company, Limited, of 88 St. David Street, Toronto, the contract for the construction of the storm sewer on Tecumseh and Briscal streets.

Montreal, Que., Outremont

A contract for sewer construction has been awarded by the town council to the Montreal Water & Power Company, 11 Place D'Armes, at $2,133.

Prince Albert, Sask.

The following contracts have been awarded by the city council in connection with the extensions to the waterworks: Cast iron pipe (probable general contractor), Can. Allis-Chalmers, Ltd., of 146 Notre Dame Ave., Winnipeg, $18,324.56; special castings, U. S. Cast Iron Pipe Co., of Burlington, N.J., U. S. A., 4,232 tons, at $42.50 per ton; Prince Albert Foundry Co., Central Ave., $699.41; valves and hydrants, Kerr Engine Co., of Walkerville, Ont., $2,716.30; laying pipe, the city engineer, 22,000 lin. ft. cast iron pipe, $14,401.91.

Rossland, B.C.

The provincial government have promised to grant the sum of $1,500 towards repairing the 2nd Avenue bridge.

Toronto, Ont.

The following contracts for the construction of sidewalks have been awarded by the Board of Control. Commr. of Works, R. C. Harris, Earl St., Grange St., O'Connell St., Roslin St.; Riverdale Concrete Paving Co., 256 Jones Ave., Kent Rd.; Queen City Concrete Paving Co., 179 Broadview Ave., Bloor St. north side; E. Bushell, 6 Westminster Ave., south side of Bloor St.

The following contracts have been awarded by the board of control for the construction of asphalt pavements:—Commissioner of Works, R. C. Harris, Beech Ave., $5,761; Bertmount Ave., $2,131; Glenholme Ave., $1,345; Lark St., $4,848; Lockwood St., $4,781; Mallow St., $3,369; Shaw St., $10.459. Constructing & Paving Co., Confederation Life Bldg., Oakwood Ave., $1,206; Westmount Ave., $6,685.
Bitulithic pavements: Commissioner of Works, R. C. Harris, Glenholme Ave., $12,654; Lauder St., $12,077; Rainsford St., $6,351. Rocmac pavements: Asphaltic Concrete Co., 74 King St. E., Regal Rd., $11,080. Asphaltic concrete pavements, Commissioner of Works, R. C. Harris, Queens Park, North End, $6,072. The board of control has awarded the following sewer contracts: Routly & Summers, 47 Sparkhill Ave., Wolfrcy Ave., $260; Beresford Ave., $808. W. E. Taylor, 438 Clinton St., Evelyn St., $1,788; Lincoln St., $443; Slatky St., $298. Patterson, Veitch & Watson, Robins Bldg., Macgregor Ave., $1,203.

Winnipeg, Man.

The Board of Control has awarded to Messrs. R. D. Wood & Company, of Philadelphia, U.S.A., the contract for the supply of hydrants, having a valve opening of 5 inches diameter, for the domestic service waterworks. The price is $37.00 each.

Messrs. Thomas Jackson & Company, of Colony street, have secured from the Board of Control, a contract for the supply of vitrified sewer pipe and special connections.

The contract for the supply of the gate valves for the domestic service waterworks, has been awarded by the Board of Control to The Empire Waterworks Supply Company of Canada.

Railroads, Bridges and Wharves

Bonila Island, B.C.
Tenders will be received by Mr. A. Johnston, of the Dept. of Marine and Fisheries, Ottawa, until Sept. 21st, for the construction of a reinforced concrete tower, frame residence, oil shed and boat house. Plans and specifications, etc., are at the Dept., Ottawa, the Agency of the Dept., Victoria, B.C., and at the post offices, Prince Rupert, Vancouver, Nanaimo, New Westminster and Comox.

Dunville, Ont.
Tenders for the construction of the station and freight sheds for the Erie & Dunnville Railway are in, and it is expected that the contracts will be awarded shortly.

Goderich, Ont.
Tenders for extension to the breakwater will be received by Mr. R. C. Desrochers, secretary to the Public Works Department, Ottawa, until Sept. 11th. Plans are at the Dept. offices of District Engineer, Windsor and Toronto, and the Post Office, Goderich.

Halifax, N.S.
Tenders will be received by Mr. L. K. Jones, secretary to the Dept. of Railways & Canals, Ottawa, until Aug. 31st, for the installation of interior fittings, heating and plumbing, and electrical equipment of shed No. 2 at the deep water terminus of the Intercolonial Railway. Plans are at the office of Dept., the Chief Engineer, Moncton, and 199 Upper Water street, Halifax.

Kensington, Ont.
The following contracting firms have examined the wharf plans, and may submit tenders. V. T. Bartram, Stair Bldg., Toronto; R. S. Elmsly, 12 Elmsley Place, Toronto; Port Arthur Constr. Co., Traders Bank Bldg., Toronto; J. O. Roddick, Washago, Ont.

Montreal, Que., Point St. Charles.
The Board of Commissioners have decided to start work on the conduit by day labor.

Ottawa, Ont.
The city has decided to start work on the alterations to the Wellington street viaduct by day labor.

Prince Rupert, B.C.
Plans have been filed with the Dept. of Public Works and at Registrar of Deeds for the construction of a wharf in the harbour opposite Lots D & E, Sev. 2.

Quebec, Que.
Plans for the construction of a wharf have been prepared by the Limoilou Land Company. The secretary of the company is Mr. J. Vien, 72½ St. Peter street. It is not likely that tenders will be called until next spring.

Walpole Twp., Ont.
The township council has decided to build a new bridge on Lot 7, Con. 11. Mr. S. A. Thompson, of Nanticoke, Ont., is the township clerk.

CONTRACTS AWARDED

Co. of Carleton, Ont.
The county council has awarded the following contracts: 1—Angus Cameron, Metcalf, $1,200, construction of a reinforced concrete culvert at Melcalf; 2—D. B. Cameron, Berwick, $1,800, construction of a reinforced concrete culvert over Bradley Creek; 4—D. B. Cameron, Berwick, $3,100, construction of concrete bridge abutments, 38 ft. 8 in. span over Carp River; 5—Ontario Bridge Company, Crown Bldg., Toronto, $3,500, for the steel superstructure for the last named.

Notre Dame de Lourdes, Que.
The municipal council has awarded the bridge contract to Mr. Alfred Mathieu, of Plessisville, Que.

Smithville, Ont.
The Hamilton Bridge Works Company, of Hamilton, has secured the contract for the construction of the bridge over Twenty Mile Creek, on the Lake Erie & Ontario Railway. It is understood that the work will be started forthwith.

Winnipeg, Man.
The Board of Control has awarded to Mr. P. D. de La Cour, of 1114 Garfield street, the contract for the labor and material required for the construction of the eastern approach to Redwood bridge.

The contract for painting Louise Bridge has been awarded to Mr. W. F. Wilson, of 287 Isabel street, at $1,64.. The painting of the Arlington Bridge will be done by day labor.

Public Buildings, Churches, Schools, etc.

Almonte, Ont.
Tenders for alterations to the post office will be received by R. C. Desrochers, secretary to the Public Works Department, Ottawa, until September 9th. Plans are at the office of the Dept., the Post Office, Almonte, and Station "F," Toronto.

Brandon, Man.
Plans for extensive interior alterations to the city hall have been approved by the city council.

Barton Township, Ont.
Tenders for the erection of a school building on the north-east corner of Barton & Weir streets will be received by the secretary, Mr. Percy H. Burgess, 31 Alexander Avenue, Homeside P.O., Ont., until August 31st. The building is to be a two-storey one of brick and stone construction, and will contain 6 rooms. The estimated cost is $25,000.

Bothwell, Ont.
Mr. W. G. Murray, architect, of London, has drawn plans for the erection of the new town hall. The building is to be of three storeys, steel and red brick construction, and will cost approximately $8,000. Tenders will be called very shortly.

Calgary, Alta.
The Glenmore school district No. 114 has been empowered to borrow the sum of $5,000 for erecting and equipping a school house. The secretary-treasurer is Mr. Milton Williams, Box 1658, Calgary.

Elsas, Sask.
The local school district No. 1904 has been empowered to borrow the sum of $7,000 for the purpose of erecting a school building. Mr. Adam Huck, of Vibank, is the secretary-treasurer.

Gretna, Man.
Tenders for the erection of the new post office will be received by Mr. R. C. Desrochers, secretary to the Public Works Dept., Ottawa, until Sept. 21st. Plans are at the Post Office, Brandon and Gretna, the Dept., at Ottawa, and the office of H. E. Matthews, Winnipeg. The building will be of 2 storeys and basement, and of concrete, brick, stone and steel construction.

Hamilton, Ont.
By their vote on the 17th instant, the ratepayers refused to sanction the expenditure of the sum of $50,000 on the erection of a public library in the east end.

McBride, B.C.
Tenders will be received by Mr. J. E. Griffith, of the Prov. Govt. Dept. of Public Works, Victoria, until noon Sept. 9th, for the erection of a court house, lockup, fences, etc. Plans and specifications are at the offices of T. W. Herne, Government Agent, S. Fort George, Chief Constable, Tete Jaune Cache and at the Dept., Victoria.

Moncton, N.B.
Mr. James Reid, the local contractor, will receive sub-tenders until Sept. 1st. for electric wiring and switching in connection with the erection of the First Baptist Church, at the corner of Church and Queen streets. Plans are with the architect, Mr. W. C. Barnes, Wyse Building.

Montreal, Que., Lachine
Tenders will be received until Sept. 3rd by the town secretary, Mr. H. Charette, for the erection of two fire stations. The architects are Mr. Dalbe Viau, 76 St. Gabriel street, Montreal, and Messrs. Bensit & Girard, Southam Bldg., Montreal. The buildings will cost approximately $15,000 each.

Tenders for the erection of the new town hall will be received until Sept. 3, by Mr. H. Charette, secretary to the town council. The estimated cost is $100,000. Mr. Dalbe Viau, of 76 St. Gabriel street, is the architect.

Montreal, Que., Maisonneuve
Tenders will be received by the secretary to the town council until noon Sept. 2nd, for supplying and laying of stone, bricking walls and plastering, in connection with the erection of the new fire and police station. Plans are with the architect, Mr. Marius Dufresne, Ontario street.

Tenders for the erection of the new Methodist Church on Pic IX Avenue, will be called by the architects, Messrs. Peden & McLaren, 20 St. Alexis street, Montreal, about the end of the current month.

Peterborough, Ont.
Tenders for the erection of post office and customs house will be received by Mr. R. C. Desrochers, secretary to the Public Works Dept., Ottawa, until Sept. 14th. Plans are at the Dept., the P. O. Peterborough and Station "F," Toronto. The building is to be of 2 storeys and basement, and concrete, brick, stone and steel construction.

Portreeve, Sask.
The local school district No. 3028 has been empowered to borrow the sum of $6,050, for the purpose of erecting and

equipping a school building. The secretary-treasurer is Mr. Emil Erickson, Portreeve.

Quebec, Que., Limoilou
La Cie des Abattoirs du Quebec, of 72½ St. Peter St., will probably not call tenders for the new premises until next spring. Mr. R. Percy Sims, of New Birks Bldg., Montreal, is the architect.

Saskatoon, Sask.
Plans for the erection of the new German Lutheran College have been drawn by Messrs. Martin, Cooper & Slater, of 115 South 2nd street. The work on the building, which will contain 18 rooms, is to be started immediately.

Toronto, Ont.
Tenders on the steel work and carpentry in connection with the erection of the registry office on Elizabeth street, have been opened. The figures are, steel, $42,114; $41,300; $42,000, and $42,600. Carpentry, $19,984; $26,150, and $20,000.

Tenders will be received by Mr. W. C. Wilkinson, secretary to the Board of Education, until noon Aug. 28th, for heating and plumbing on Duke of Connaught school, and cabinet work, iron fences and terra cotta cornices on various other schools. Plans are at the office of supt. of Bldgs., City Hall.

Messrs. Norcross Bros., 98 Bay St., are receiving sub-tenders for trades on work connected with the erection of the new commercial high school.

The time for receiving tenders on the erection of Forrest school, High Park, has been extended to August 28th.

Victoria, B.C.
Mr. J. C. M. Keith, architect, of 416 Sayward Bldg., is inviting tenders for general contractor for the erection of the jail on Fisquard street. The new building is to be 4 storeys high, of brick, stone and concrete construction. The estimated cost is placed at $80,000.

Vancouver, B.C.
Tenders on the erection of the new Jewish Synagogue on Melville street are invited by the architects, Messrs. Braunton & Leibert, Exchange Bldg. The estimated cost is $20,000.

Watford, Ont.
Tenders for the erection of a post office will be received by Mr. R. C. Desrochers, secretary to the Public Works Department, Ottawa, until Sept. 14th. Plans are at the office of the Dept., Station "F," Toronto, and Post Office, Watford. The estimated cost is $25,000.

Waterloo, Ont.
The plans of Mr. Chas. Moogk, the town engineer, have been accepted for the installation of a hot water system, and the general re-arrangement of the ground floor of the town hall.

CONTRACTS AWARDED

Joliette, Que.
The school commissioners have awarded to Mr. Caille Martel the contract for the erection of the pubilc school.

Regina, Sask.
The Provincial Public Works Dept. has awarded to the Parsons Construction & Engineering Company the contract for the erection of the power-house, septic tanks, and six residences, in connection with the new provincial jail buildings.

Business Buildings and Industrial Plants

Brampton, Ont.
Mr. H. Westoby, of Glasgow street, Guelph, is interested in the proposed erection of a plant of the Imperial Iron & Steel Company. The building is to be of reinforced concrete and brick construction and is estimated to cost $13,500.

Dorchester, N.B.
The charter of the recently incorporated Eastern Linen Mills, Limited, empowers the company to construct the works and machinery necessary for the carrying on of its business. Amongst those interested in the project is Mr. John L. MacKinnon, of the Keith Bldg., Halifax.

London, Ont.
Dr. D. N. Arnott, of 226 Queens Ave., is forming a Canadian company to manufacture the "Favary" tire. The company expects to commence operating this fall. Premises will be rented at first, but it is understood that a building will be erected later.

Montreal, Que.
Messrs. MacVicar & Heriot, architects, of 104 Union avenue, are drawing plans for the erection of an office building at the corner of Bluery and Concord streets, for Messrs. Caron Brothers. It has not yet been decided whether the building will be erected this fall or postponed until next year.

The Toilet Laundry Company, of 425 Richmond street, proposes to expend the sum of $75,000 on extensive additions to its premises. The architects are Messrs. Hutchinson, Wood & Miller, of the Royal Insurance Bldg., who will call for tenders in the near future.

Mr. J. H. McDowell, of the Drummond Bldg., having been appointed architect for the erection of a theatre at the corner of St. Catherine and Mountain streets, is now engaged in drawing the necessary plans. The estimated cost of the building is $200,000.

Messrs. Barott, Blackadder & Webster, of the New Birks Building, will be associated with Mr. P. A. Westover, of Philadelphia, as architects for the erection of the new theatre which is to be erected on St. Denis and St. Catherine streets, at a cost of $300,000.

Montreal, Que., Maisonneuve
It is understood that work on the additions to the premises of La Parisienne Shoe Company, La Salle Avenue, will be started next spring.

Montreal, Que., Outremont
Seaman Kent, Ltd., of Durocher St., have obtained a permit for the erection of a warehouse and office. Sub-tenders for minor trades will be called later.

Plans for the erection of a dairy building on Hutchinson street, have been drawn for Mr. H. Caudlish, 581 Durocher street.

Ottawa, Ont.
Mr. W. G. Wilson, of 1083 Wellington street, has under consideration the erection of an office on Pintey street.

It is understood that the Connell Anthracite Mining Company, of 21 Bank street, are about to apply to the Board of Control for the necessary permission for the erection of coal sheds on Hawthorne street. The buildings will be 200 ft. long by 66 ft. wide, and will be of ironclad construction.

Port Arthur, Ont.
Sketches for the erection of a branch of the Bank of Montreal, at the corner of Park and Cumberland streets, have been drawn by Messrs. Barott, Blackadder & Webster, of Montreal.

Redcliff, Alta.
Work is to be started at once on the erection of a brass product plant for the Imperial Brass Manufacturing Company, of Chicago. The building will be 150 ft. long by 40 ft. wide, of brick construction, and is expected to be completed this year.

St. Catharine, Ont.
A site on Carleton street has been purchased by Messrs. Krower and Griffin, of Buffalo. The purchasers propose to erect a factory for the manufacture of underwear.

Toronto, Ont.
Mr. J. T. Walters, of 103 Shuter St., has had plans drawn for the erection of a store and office at the corner of Jarvis and Shuter streets.

Plans are now about ready for the erection of the Farmer's Dairy Company's building at the corner of Walmer road and Bridgeman street. Tenders for excavating are now open. The architects are Messrs. Symons & Rae, Sun Life Building.

Plans for additions to the premises of the Wm. Davies Company, corner of College street and Ossington avenue, have been drawn. The estimated cost is $10,000.

Winnipeg, Man.
According to the charter of the recently incorporated City Dairy Company, the company is empowered to construct the necessary buildings incidental to the carrying on of its business. The solicitor for the company is Mr. A. G. Kemp, 18 McMillan Crescent.

CONTRACTS AWARDED

London, Ont.
The following contracts for the alterations to Mr. Rowland Hill's shoe store on Dundas street has been awarded. General contractors, Tambling & Jones, 282 Horton St., metal store front, Kawneer Mfg. Co., 1191 Bathurst St., Toronto.

Ottawa, Ont.
The contract for the alterations to stores on Rideau street has been let to Messrs. Alex. Christie & Son, 359 Elgin street.

Regina, Sask.
The contract for the erection of the store and apartment block on Albert street for Mr. E. McCarthy, has been secured by the McKay Construction Company of this city.

Victoria, B.C.
Messrs. Luney Brothers, 508 Sayward Building, have the contract for the erection of a number of stores on Fort and Blanchard streets, for Messrs. C. R. Brown and W. R. Hull.

(Continued on page 66)

Tenders and For Sale Department

NOTICE is hereby given that the time for the reception of tenders for Negro Point Breakwater, St. John, N.B., is extended to Wednesday, October 7th, 1914.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 17th, 1914. 34

Greater Winnipeg Water District

Tenders for Aqueduct Construction

Sealed tenders addressed to the undersigned will be received up to noon of **Saturday, 19th September, 1914**, for the construction of Eighty-five miles of concrete aqueduct in five sections of approximately equal length.

Plans, specifications and form of tender can be secured after July 20th, 1914, by application to the District accompanied by certified cheque for One Hundred Dollars payable to the District, which deposit will be returned upon submission of tender or return of documents.

Bidders may tender on any section or on any number of sections.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,
Chairman of Commissioners
901 Boyd Building,
Winnipeg, Man., July 6, 1914. 30-36

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Peterborough, Ont.," will be received at this office until 4 p.m. on **Monday, September 14, 1914**, for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Peterborough, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 18, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—65372. 34-35

Tenders for Restaurant Privileges

Sealed tenders addressed to the undersigned, marked on envelope "Tenders for Restaurant Privileges," will be received up to 12 o'clock noon, **September 15, 1914**, for the privileges for periods of one year, two years, five years, at the following places—leases to become effective from the dates mentioned.

Timagami Restaurant—from February 10, 1915.
Englehart Restaurant—from October 1, 1914.
Cochrane Restaurant—not yet opened.

Parties tendering will be required, if found necessary, to furnish bond that any agreements entered into will be carried out.

Highest or any tender not necessarily accepted.

Dated at Toronto this 22nd day of August, A.D. 1914.

A. J. McGEE, Secretary-Treasurer,
T. & N. O. Railway Commission,
34 25 Toronto St., Toronto.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Extension of South West Breakwater at Goderich, Ont.," will be received at this office until 4 p.m., on **Friday, September 11, 1914**, for the construction of harbour improvements, being an extension to the South West Breakwater at Goderich, Huron County, Ont.

Plans and forms of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Windsor, Ont.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Goderich, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $25.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,
R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, August 21, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—65626. 34-5

FOR SALE—One "Smith" concrete mixer in first class condition. Cost $950. Will sell for $600 cash. Apply Box 72, Contract Record, Board of Trade Building, Montreal 33-36

For Sale.—One Kemp Continuous Mixer, capacity guaranteed 15 cu. yds. per hour, steam, own traction, practically new. Price $600, f.o.b. shipping point. Address John H. Gordon, Albany, N.Y. 34-35

Agents Wanted

Large firm making diaphragm pumps with improved patent valves wants to secure agents in Canada. Pumps made in all capacities up to 14,000 gallons per hour. Workable by hand or mechanical power. Address Box 70, Contract Record & Engineering Review, Toronto. 32-37

Positions Vacant

WANTED—Immediately, an experienced traveller to represent us in Ontario for high class interior finish, hardwood flooring, etc.

WILSON BROS., LIMITED,
34 Collingwood, Ont.

School of Mining and College of Applied Science, Queen's University, Kingston, Ontario. Applications will be received by the undersigned until **September 15th**, for the position of Professor of Civil Engineering, at a salary of $2,500 a year, commencing October 1, 1914. Applicants must be graduates of an engineering school, and preference will be given to men with practical railway engineering experience. The session of the school of mining extends over thirty weeks. Geo. Y. Chown, secretary. 33-34

Positions Wanted

Position wanted by reliable waterworks and sewers construction foreman. Good draughtsman; knowledge of transit and level; excellent references. Box 69, Contract Record, Toronto. 31-34

New Companies

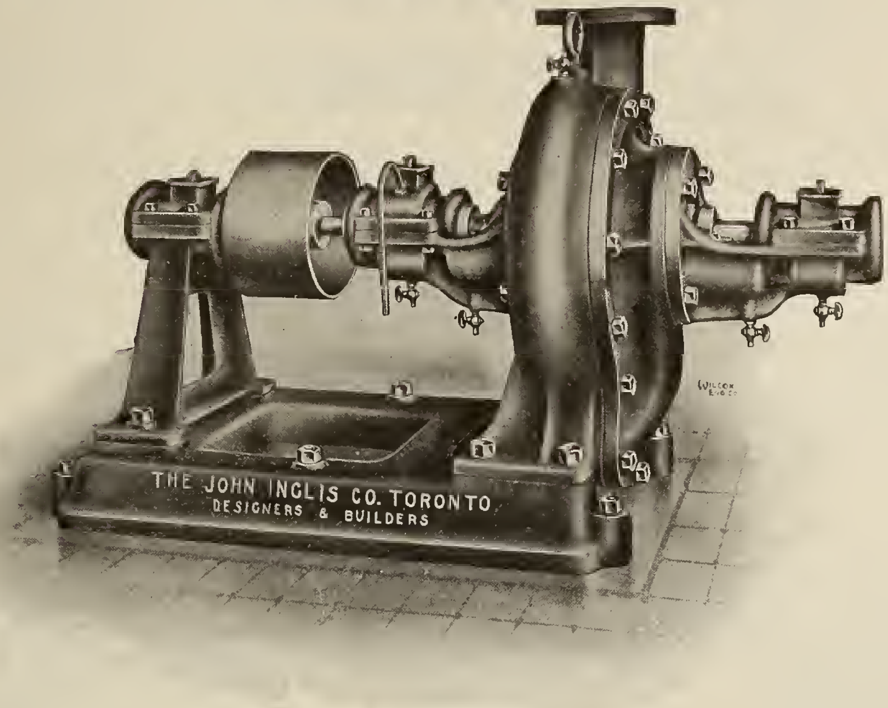
South Kensington Land Company, Limited, has been incorporated with a capital of $200,000, with head office at Toronto. The provisional directors are D. R. Leask, F. H. Vanston, R. A. Stephen, and J. N. Parkin, all of Toronto.

Fibred-Asphalt Paving Company, Ltd., has been incorporated with a capital of $500,000, with head office at Toronto. The provisional directors are M. T. Mathews, R. C. LeVesconte, V. J. Callen and S. A. Murray, all of Toronto.

Dartmoor, Limited, has been incorporated with a capital of $162,000, with head office at Toronto, to carry on business as stone, gravel and sand merchants. The provisional directors are L. F. Black, H. A. Hall and W. B. Henderson, all of Toronto.

North Canada Lumber Company, Ltd., has been incorporated with a capital of $100,000, with head office at Prince Albert, Sask.

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Residences

(Continued from page 63)

Ancaster Twp., Ont.

Messrs. Munro & Mead, of 32 Main street, Hamilton, have plans in course of preparation for the erection of a residence for Mr. John McNevin who is inviting tenders for brick work and masonry. The estimated cost is $6,000.

London, Ont.

Messrs. Watt & Blackwell, of Bank of Toronto Chambers, will have plans ready shortly for a residence on Hyman street, for Mr. W. E. Saunders.

Montreal, Que.

Mr. D. J. Creighton, architect, of the Jacobs Bldg., invites tenders for separate trades connected with alterations and additions to a residence on Mansfield street.

Ottawa, Ont.

The erection of a residence on Sherbrooke street is being considered by Mr. W. R. Clarke, of 1017 Wellington street.

Mr. Peter Boucher, of 144 Maple St., has under consideration the erection of a residence on Pinchurst street.

Mr. Thomas Deane, of 170 Cambridge street, proposes to erect a residence on Hickory street, at an estimated cost of $5,000.

Point Grey, B.C.

The Lee Mason Company, of 561 Broadway W., Vancouver, who have the general contract for the erection of a residence on 38th avenue west, for Messrs. E. D. Rorke & Company, are inviting tenders for sub-contracts and material.

Winnipeg, Man.

Mr. C. G. Johnson, of 21 Canada Life Building, and Mr. D. C. Wyman, of 506 McGreevy Block, propose to erect residences in the city in the near future.

The Canadian Syndicate Investments Ltd., of 210 Somerset Block, contemplates erecting a number of residences in the city in the near future.

Mr. Solimon, of 881½ Main street, proposes to erect a residence, although it is probable that the work thereon will not start until late this year.

The erection of residences on Garfield and Sargent streets is being considered by Mr. James Bergman, 714 Lipton St.

Mr. J. Alderson, of Ingersoll street, proposes to erect a number of residences in the city in the near future.

Winnipeg, Man., Grand Vital

It is understood that the erection of a residence at Windsor Park is being contemplated by Mr. B. Beavis, of 307 Union Trust Building.

Winnipeg, Man., Fort Rouge

The Walley Construction Company, of 408 McArthur Block, Winnipeg, proposes to erect a residence on McMillan Avenue, at an estimated cost of $7,500.

Mr. J. Stephensen, of the Manitoba Realty Co., McIntyre Block, Winnipeg, has under consideration the erection of a residence on McMillan Avenue.

CONTRACTS AWARDED

Hope, B.C.

Mr. A. W. Cox has secured the contract for the erection of a residence for Mr. R. H. Wardle, on Commission and Fraser streets.

Ottawa, Ont.

The contract for the erection of apartments and stores on Nelson street for Mr. Walter A. Molsen, has been awarded to Mr. John Fleming, Wellington St.

Toronto, Ont.

Mr. Robert Robinson, of 1310 Lansdowne Avenue, has secured the contract for the erection of a residence on Bracondale avenue for Messrs. McAffee and Elliott Brothers.

Power Plants, Electricity and Telephones

London, Ont.

Plans are being prepared by Mr. H. J. Glaubitz, City Hall, for the construction of 2 water wheels, turbine pumps and synchronous motors and other accessories at the Springbank Pumping Station. This machinery is not to be installed until next spring.

Montreal, Que.

Tenders for the installation of the underground cables of the fire alarm department will be received by the Board of Commissioners until noon Friday, August, 28th. Specifications, etc., are at the office of Supt. of the Dept., 231 Ontario street west, Montreal.

Surveys have been made by the Board of Commissioners for the installation of 200 Standard lamps, and it is understood that tenders will be called at once.

Comber, Ont.

The ratepayers have passed the by-law to raise the sum of $4,500 for securing power from the Hydro-Electric Commission.

CONTRACTS AWARDED

Regina, Sask.

The following contracts have been awarded on the power house equipment by the City Council (light and power department). Babcock & Wilcox, 85 Liberty St., New York, N.Y., two 7-in. and two 3-in. crane gate valves; two 7-in. lagonda and two 3-in. crane non return valves, $825. Sanford-Riley Stoker Co., Readville, Mass., spare parts for stoker and economizer, $315.16. B. F. Sturtevant Co., Hyde Park, Mass., spare parts for economisers, $687.50.

Miscellaneous

Hamilton, Ont.

On the 17th instant, the ratepayers decided against the purchase of the quarry and equipment. The project would have involved the expenditure of $75,000.

Toronto, Ont.

The bids for the construction of a coal and ash handling apparatus at the main pumping station, which were opened on the 21st instant, were referred to the commissioner of works, as alternate bids were submitted.

CONTRACTS AWARDED

Dunnville, Ont.

The Erie & Dunnville Railway authorities have awarded to Mr. Robert Bennett, of this town, the contract for grading and constructing wire fences for the entire length of the right-of-way from Dunnville to Smithville.

Winnipeg, Man.

The J. H. Ashdown Hardware Company has secured from the Board of Control the contract for the supply of 60 tons of lead.

Business Notes

Beverley Twp., Ont.

The large barn, drive sheds, stables, etc., belonging to Mr. John Whetham, of Kirkwall, were destroyed on August 16th. The loss is covered by insurance. The buildings will probably be rebuilt this fall.

Cedar Grove, Ont.

Mr. James Boyd recently sustained a loss of about $7,000 when his barn was destroyed by fire.

Walkerville, Ont.

The pattern shop of the Kerr Engine Company, Walker road, has been destroyed by fire; the loss of about $7,000 was covered by insurance.

Winnipeg, Man.

The elevator of the Union Grain Company has been destroyed by fire. The loss of $15,000 was covered by insurance.

New Companies

The Attercliffe Standard Brick Block and Tile Company, Limited, has been incorporated with a capital of $40,000, with head office at Attercliffe Station, Ont. The provisional directors are W. Stringer, J. E. Moote, and T. J. Kennedy, all of Attercliffe Station, Ont.

Anglo Canadian Construction Company, Limited, has been incorporated with a capital of $100,000, with head office at North Bay, Ont. The provisional directors are J. T. Lindsay, R. L. Dudley, and H. R. Miles, all of North Bay, Ont.

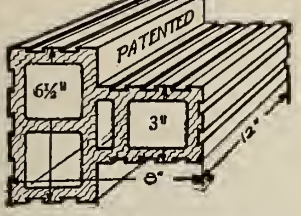
Lime & Agencies, Limited, has been incorporated with a capital of $40,000, with head office at Toronto, to carry on business as manufacturers of brick, terra cotta, tiles, drains, sewer pipe, etc. The provisional directors are J. Stewart and W. H. Latimer, both of Toronto.

The Field Lumber Company, Limited, has been incorporated with a capital of $50,000, with head office at Field, Ont.

Universal Drilling and Contracting Company, Limited, has been incorporated with a capital of $1,000,000, with head office at Calgary, Alta.

Anglins Limited
GENERAL CONTRACTORS
65 Victoria St. MONTREAL
507 Lumsden Bldg. TORONTO

REID & BROWN
Manufacturers of
GARBAGE AND REFUSE INCINERATORS
Steel Beams, Channels, Angles, Plates, Column Sections, etc., Always in Stock
Phone Main 904-905
Office and Works: 62 Esplanade E., Toronto.



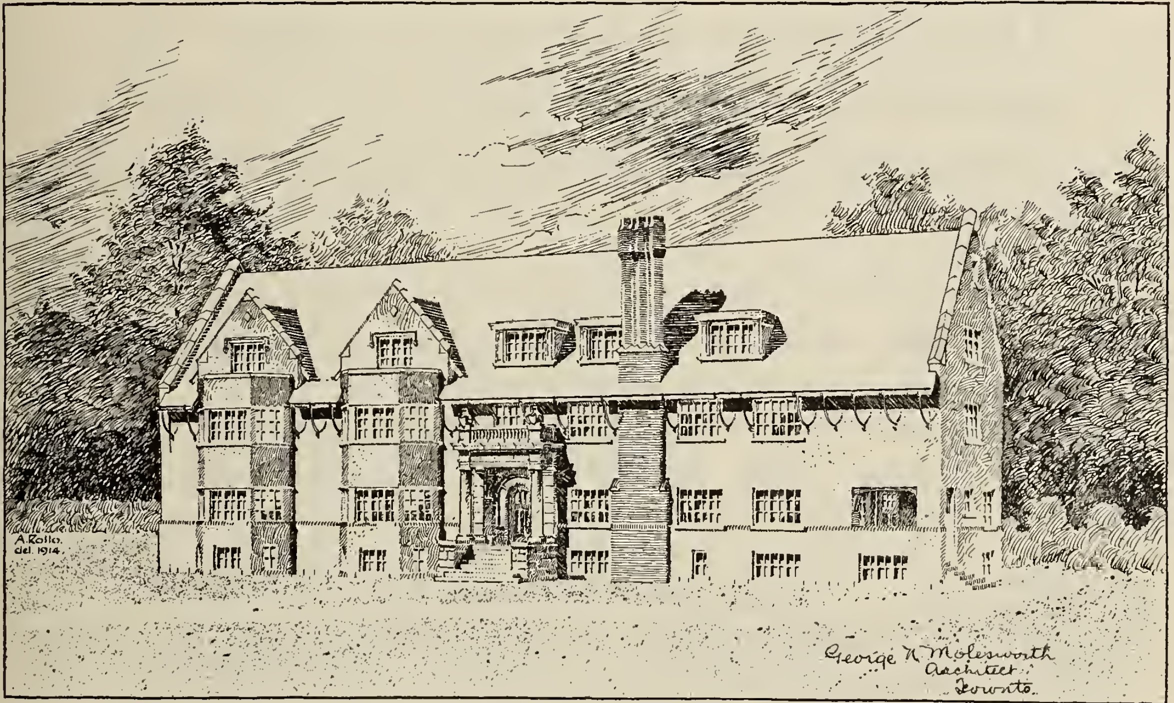
It interlocks.

DENISON

Interlocking Hollow Tile

The one size and shape builds all thickness of walls.

Impervious to moisture, heat or cold. Specified in the construction of the building illustrated by reason of this quality, peculiar to itself.



Orphanage for I. O. O. F. **Built like a Thermos Bottle** Oakville, Ont.

Architect:—Geo. N. Molesworth. Gen. Contractors:—Sutherland Construction Co.

Write or phone us for any information you may desire

The One Price Company

Sun Brick Company, Limited

Traders Bank Building

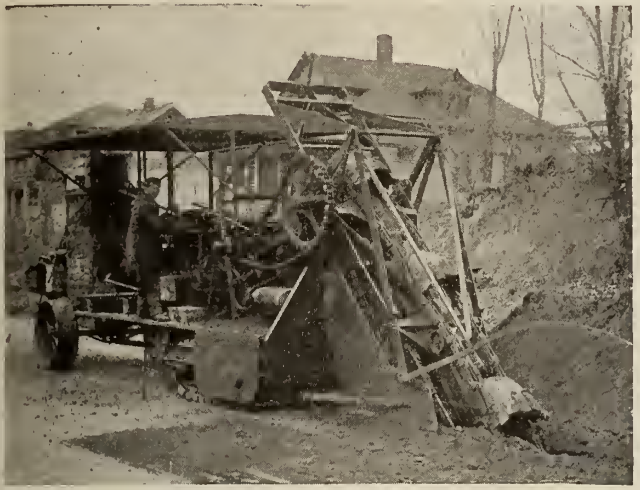
The Business Outlook in Canada

TRULY it is an ill-wind that blows nobody good. One Continent's "down" is another Continent's "up." The industries of Europe are, generally speaking, at a standstill, and matters will be worse before they can be better.

The whole world is looking to the North American Continent — to Canada and the United States—for much of its provisions, machinery, textiles, boots and shoes, beverages, vehicles, cement, brick, earthenware, fancy goods, furs, glass, garments, paper, soap, tobacco, wood products, and much else. Canada must get ready to meet the demand made upon her. We have continued prosperity ahead of us if our manufacturers and merchants rise quickly to take advantage of their opportunity.

It is a time for business hopefulness, not for business gloom.

1000 feet a day for 1$\frac{1}{6}$ cts. a foot total cost



No. 00 Austin Trench Excavator at Sioux Falls, S.D., digging a sewer ditch nearly 13 ft. deep. Bringing up 28 in. boulders.

And "taking things easy" at that! Yes, an Austin Trenching Machine No. 00, in Aurora, Illinois, U.S.A., worked for about 1 1-6 cents a foot cost, INCLUDING cost of operator, assistant, board bill of operator, some teaming, gasoline, lubricants and a few minor repairs.

What secrets lie behind this phenomenal ability of Austin Trenching Machines? None. Simply GREAT care in attention to details, the elimination of the old-fashioned "shift mechanism;" the use of the **straight pull**; the buckets digging constantly the full width of the trench.

Austin Trenching Machines represent the culmination of a quarter of a century of actual practical working experience and close contact with the requirements of the contractor in the field.

Write to our Canadian Representatives—the one nearest you.
Lecky & Collis, Limited. 49 Beaver Hall Hill, Montreal; 43 Scott St., Toronto, and P. O. Box 611, Napanee, Ontario.
Canadian Equipment & Supply Co., Calgary and Edmonton. E. G. Cullen, 418 Pacific Bldg., Vancouver
Dominion Equipment & Supply Co., Winnipeg, Manitoba

F. C. AUSTIN DRAINAGE EXCAVATOR CO. Railway Exchange, CHICAGO, U. S. A.
Agents Wanted in Open Territory

The "H & H" Dependable Switch

Do you know that the householder is very apt to judge the quality of the whole electrical installation by the Wall Switch ?

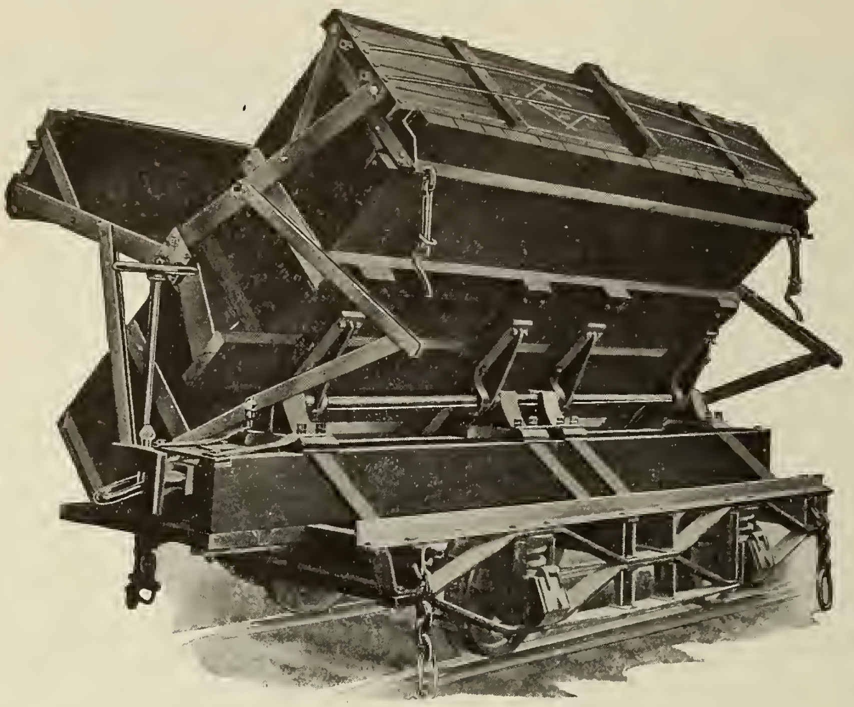
He uses the Switch daily, and if it does not work smoothly, makes a noise, or breaks down, it is only natural for him to assume that you have given him an inferior job. For this reason, do you not think that your reputation rests, to a very great extent, upon your selection of a good, dependable Switch ?

"H & H" Switches are the result of twenty-three years' specialization on the manufacture of this one type of device. The chief object of the Manufacturers is to make them durable above all things.

The list prices on "H & H" Push Switches and Struck-up Plates have recently been reduced.

CANADIAN GENERAL ELECTRIC CO., LIMITED

HEAD OFFICE : TORONTO. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert.



GLENGARRY

You Want a Steel Frame Car to Have Long Life

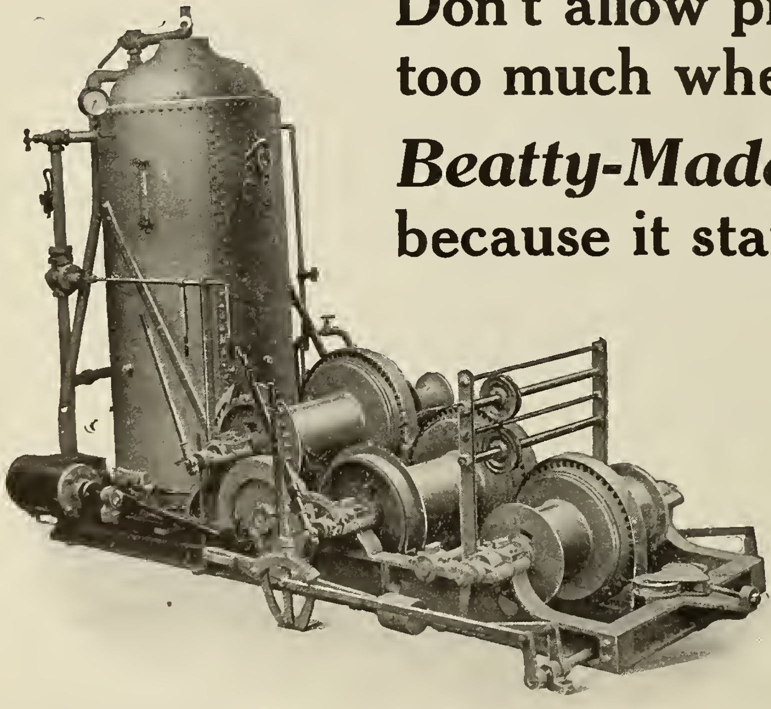
This new steel frame car will not disappoint. It is built for hard use and lots of it. STUDY THE CONSTRUCTION. Note the under frame support of box. This box cannot sag down. See the bracing of box ends and doors! The drawbars are bolted clear through to "I" beam girts. The diamond frame is the stiffest possible. Note angle on top instead of flat iron bar. The bracing and trussing of these cars is excellent. Arch braces are trussed across drawbars distributing load on trucks in proper form. You could not build a better car!

Watch next week's issue!

Cut showing 4 and 6 yard Double Diamond Steel Frame Car in dumped position. Full 45 degrees. Door opens away from load.

Last week we began this series showing why our cars deserve your attention and enquiry. Look it up. Keep posted. WRITE NOW.

The Schell Foundry and Machine Company, Limited
ALEXANDRIA - - - - - ONTARIO



Don't allow price to influence you too much when buying plant.

Beatty-Made Equipment is cheap because it stands up to the work—

Steam Hoists, Electric Hoists, Clamshell Buckets, Derrick Fittings, Steel Derricks, Centrifugal Pumps.

All kinds of Dredging Machinery, Dump Scows, Floating Derricks.

Clamshell and Dragline Excavators. Travelling and Revolving Derricks.

Stone Skips, Concrete and Coal Tubs, etc.

SEND FOR CATALOGUE No. 21

M. BEATTY & SONS, LTD.
WELLAND, CANADA

Established 1862

—AGENTS—
H. E. Plant, 1790 St. James Street, Montreal
R. Hamilton & Company, Vancouver, B. C.
H. W. Petrie, Limited, Toronto
E. Leonard & Sons, St. John, N. B.
A. R. Williams Machinery Company, Winnipeg, Man.

Standard Hoist with two friction Drums and Swinger

JAMES THOMSON, President. J. G. ALLAN, Vice-President. JAMES A. THOMSON, Secretary.

THE GARTSHORE-THOMSON PIPE & FOUNDRY CO.
LIMITED

Manufacturers

Flexible and Flange Pipe, Special Castings and all kinds of Waterworks Supplies.

3 inches to 60 inches diameter
for Water, Gas, Culvert and Sewer

HAMILTON, ONT.

One man lifting 1800 lb. casting.

SPEAKS
FOR
ITSELF

to the contractor who wants to save on his pay roll.

The
LAURENT-CHERRY
CAPSTAN
PULLEY BLOCK

Three sizes

No. 2 Block, ¼- or ⅜-in. Rope, Weight 3 lbs., Capacity ¼-ton......5.50
No. 4 Block, ½-in. Rope, Weight 14-lbs., Capacity ¾-ton 11.10
No. 6 Block, ⅝- or ¾-in. Rope, Weight 27 lbs., Capacity 2 tons....17.00
Capstan Block alone ⅔ above prices.

Sole Canadian Agents and Distributors:
MILLS BROS.
215 Ryrie Bldg. - Toronto, Canada

Stair at Provincial Museum, Toronto.

This is a good example of Meadows' stair work. Our plant is complete for the successful manufacture of this particular class of work. Specifications can be followed or we will submit designs. Careful attention to details and thorough workmanship have made Meadows' stair work popular.

QUOTATIONS FURNISHED.

The GEO. B. MEADOWS
Toronto Wire, Iron and Brass Works Co., Limited
Meadows Block, Wellington St. W.
TORONTO, ONT.

RAILS New and Relaying
Switches, Turntables, Etc.

Carried in Stock

Locomotives and Cars

Jno. J. Gartshore, Toronto

Tenders

A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Vault Doors and Safes

J. & J. Taylor

Toronto Safe Works

Established 1855 **TORONTO**

Branches: Vancouver and Winnipeg

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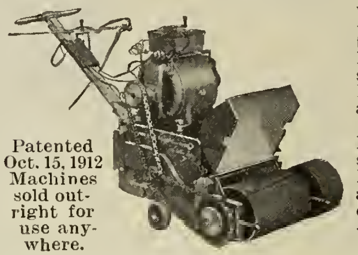

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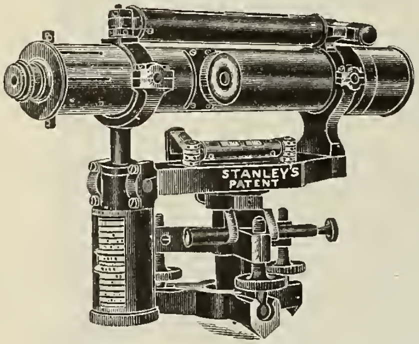

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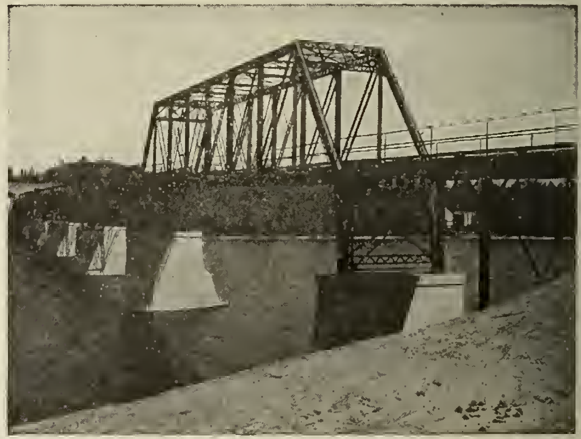

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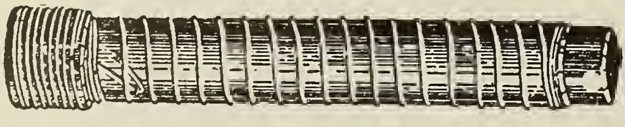

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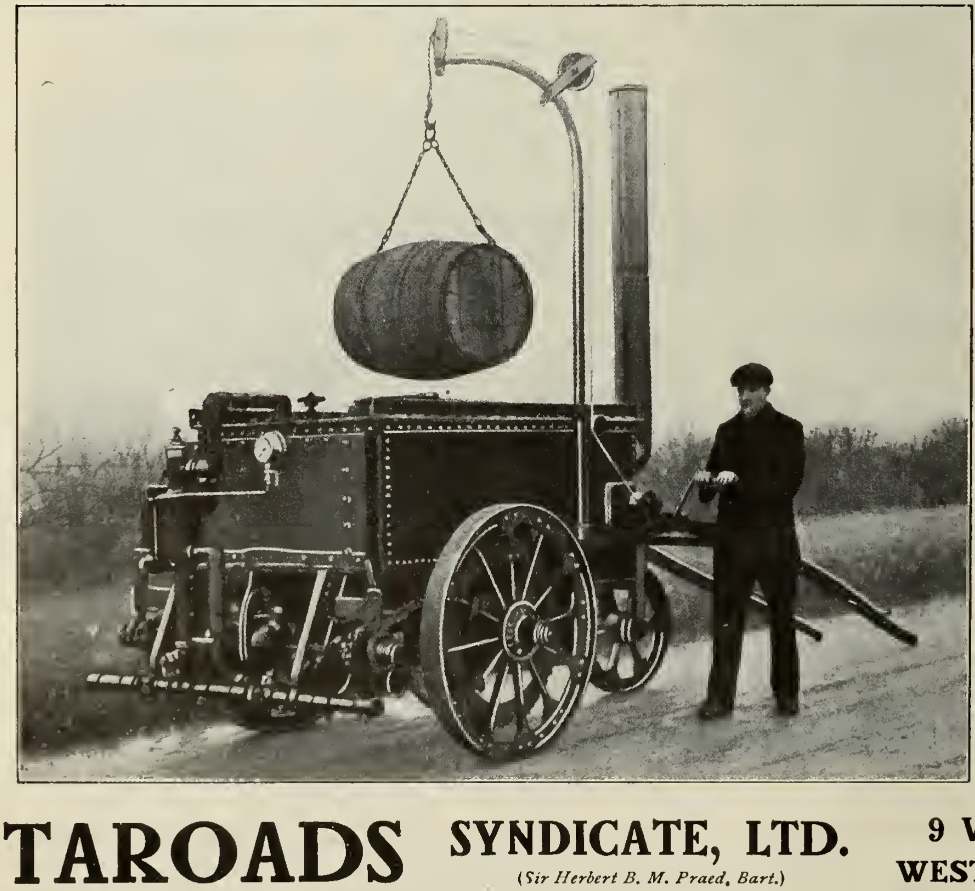

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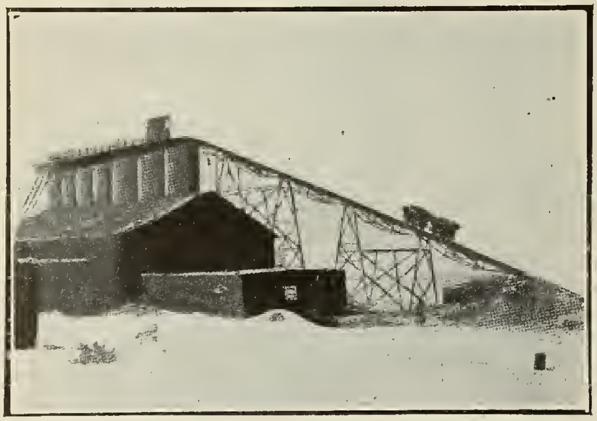

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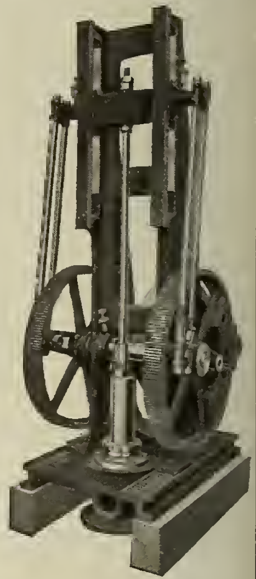

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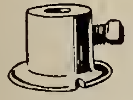

Fig. 1

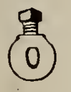

Fig. 2

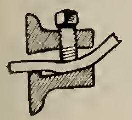

Fig. 3

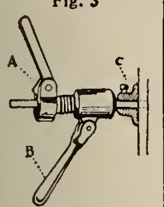

Fig. 4

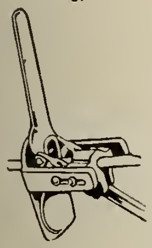

Fig. 5

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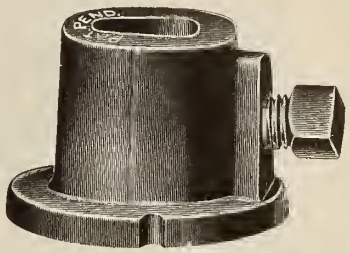

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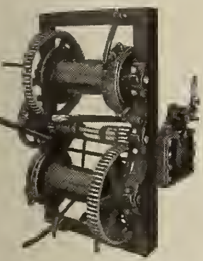
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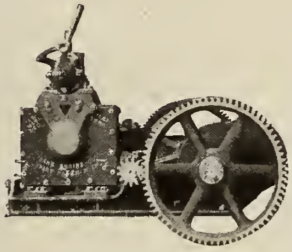
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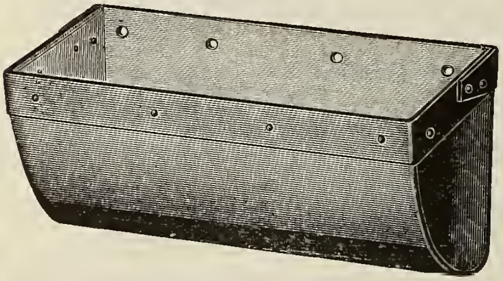

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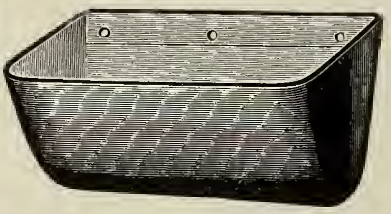

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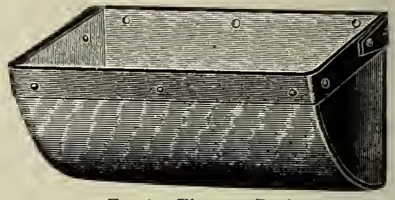

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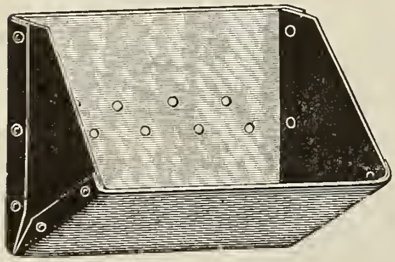

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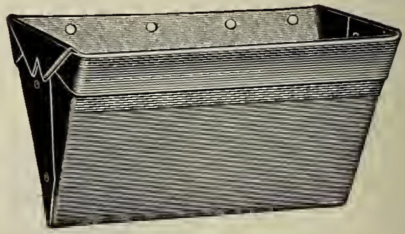

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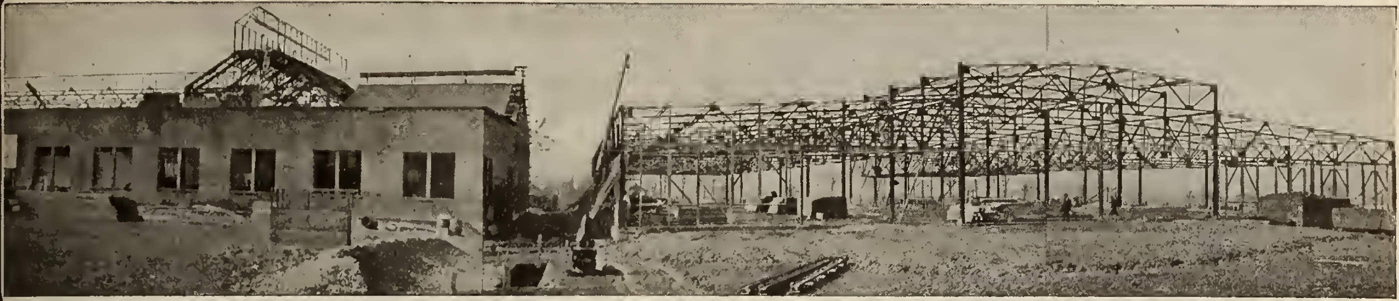

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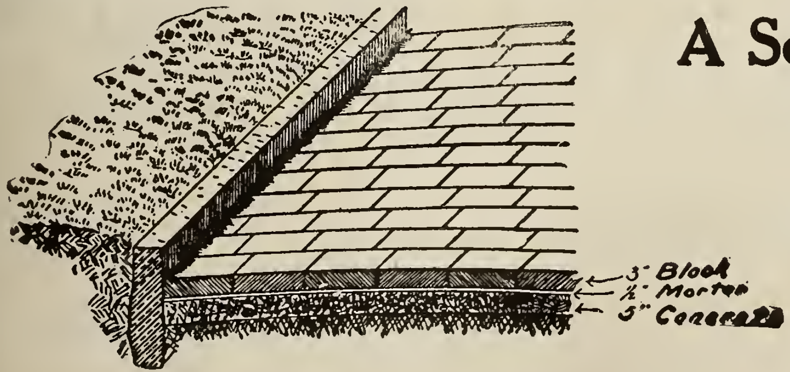

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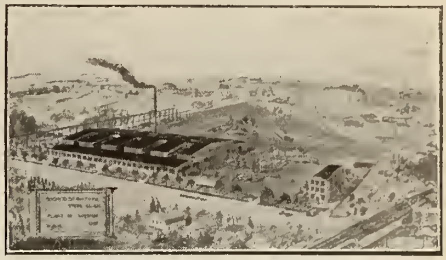

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Sanitary and Impervious

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Bridges—Steel Buildings
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OUR NEW OFFICE AND WORKS: 1139 SHAW STREET
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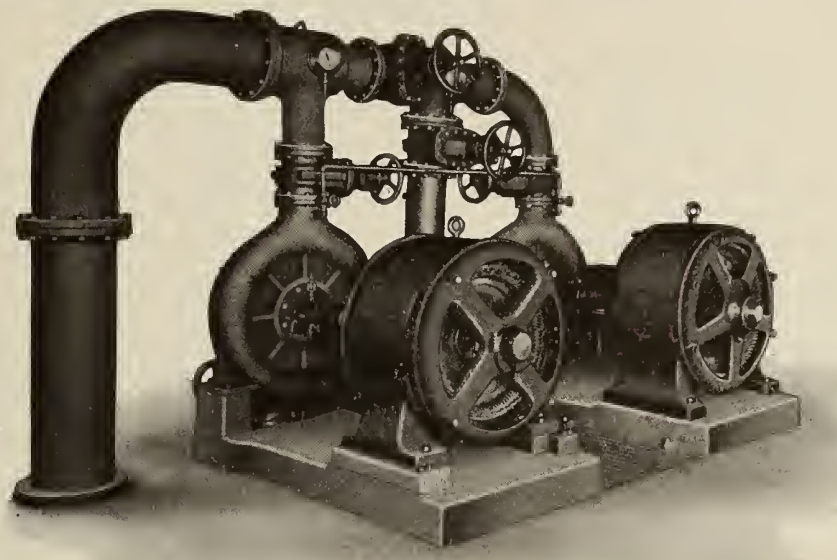

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Current Prices of Building and Engineering Materials

General View of Market Conditions

IN the constructional field in Toronto, and the East generally, trade has shown improvement, generally speaking, since operations commenced on an extensive scale within the last few weeks. The prospects for a continuance of this advance, however, cannot be described as encouraging, the determining factor being, of course, the European war. Since the outbreak of hostilities, some important public works which had been well under way have been held up indefinitely owing possibly to the difficulty of negotiating the necessary loans to finance the undertaking. In view of these unlooked-for events the outlook for the future is uncertain.

Notwithstanding the present instability in the constructional field, the demand for almost every kind of builders' supplies is moderately good. Of course, cancellation of a number of important constructional projects in and around Toronto is responsible for a slackening off in the demand for crushed stone; otherwise the market for this commodity, as also for sand and gravel, would have been unusually active. Brick manufacturers report only a moderate demand, while few extensive orders are being handled. The same is true with regard to cement, lime and related materials. Sewer pipe has been in good demand for some time past and the trade has not, as yet, been affected by the European situation. In the steel trade there is a feeling of uncertainty, and prices have advanced to such an extent within the last ten days that all quotations have been withdrawn, dealers preferring not to quote on any but specifications. We believe that a firm condition of the market will continue and that activity will be stimulated greatly before the end of the present month. Toronto prices for paints and oils have shown an upward tendency, white lead having advanced 25c since our last review. An advance of 9c per gallon is reported for linseed oil, an advance being also noted on red lead. Market conditions in these commodities are reported very good and there is reason to believe that there will be still further improvement. Business is rather good in regard to corrugated and galvanized iron and it is expected that prices will continue firm for some time.

At Montreal, practically every department of constructional business is affected more or less by the European situation. Naturally, contractors are adopting a policy of caution under present conditions. In many quarters, however, it is felt that a pessimistic view is not justified and that we shall not be so severely hit as some would lead us to believe. We have immense natural resources, which, in the absence of foreign supplies, may be more fully developed, and thus in the future we shall be less dependent on outside production. In the meantime the country is being adversely affected, particularly in those instances where Canada has relied to a large extent on European manufactures and raw material. The one bright spot at the time of writing is that business in such materials as sand, brick, etc., has not declined to an appreciable extent, although it is expected that the restriction of building operations will have an effect in the immediate future. Collections are stated to be difficult. There is a large amount of brick on offer. The iron and steel and allied trades are dull, and naturally the representatives of European firms have almost ceased doing business. Rope is a strong market, and prices are higher, owing to the difficulty in obtaining supplies, due to the war. Explosives are in slow demand.

At Winnipeg, the war situation in Europe is curtailing building activities to a very great extent, and the demand for materials of construction leaves a good deal to be desired. One favorable feature of the situation is that crop reports, while not so good as those of last year, are none the less satisfactory. In many parts of the country prolonged drought has done much damage, but in the aggregate a fair harvest is assured, and it is, moreover, being reaped under good weather conditions. Combined with the certain rise in the price of wheat and grains which the war will bring about, this will mean wealth to the farming community, and as the general indchtedness of this class has been greatly reduced by the proceeds of last year's crop and the subsequent period of enforced economy, the farmers should have money to spend on improvements and new buildings as soon as the harvest is over.

At present the call for almost all the materials of construction throughout the West is very small. Little lumber is being sold, and conditions in the trade will remain dull until the harvest is over and the farmers are free to consider undertaking improvements. The demand for brick, which has been quite satisfactory on the whole during the season, has fallen off very considerably, and the same holds good of cement, sewer pipe, reinforcing steel and other structural materials. There is a fairly satisfactory movement of paints and oils, roofing materials, plaster and similar lines.

At Vancouver conditions in the building trade appear to be more generally active than during the early part of the summer and as a consequence the movement of building supplies has become a little freer and continued improvement is being looked ofr. There is undoubtedly greater activity in the field of residential construction than has existed for some time past, and with several undertakings projected, representing heavy expenditure in the aggregate, the situation as regards the larger classes of work may also be said to have assumed a more cheerful aspect. Finishing and casting plasters are in fair demand at the present time despite a steadily advancing market, and the call for lime, sand, slate and the various lines of cement is perceptibly improving. There is only a very moderate demand for brick, however, and the outlook in this market is regarded as somewhat dull. According to local dealers in crushed stone, sand and gravel, the probabilities of satisfactory marketing conditions holding for the ensuing month are rather uncertain owing to the fact that most of the paving work which has been proceeding for the past two months or so is now practically completed, and the unwillingness of local paving concerns to undertake any additional contracts pending more settled conditions in Europe. The outbreak of hostilities on the Continent is also held responsible for the prevailing feeling of uncertainty in the steel trade, prices having advanced at least $3.00 a ton in the Vancouver market since war was declared and showing every indication of further stiffening before the latter part of August. Dealers display the utmost timidity in quoting prices on large tonnages in view of the unsettled condition of the market, and quotations are only being made on specifications with mill deliveries doubtful. The opinion is prevalent here that the withdrawal of foreign mills from the export trade will have the effect of stimulating activity in both the Canadian and United States industries during the closing quarter of the present year with prices tending higher. There is no apparent improvement in the demand for steel at Coast points and it is unlikely that any material increase in trade will develop here for the next six months. Quotations on galvanized and corrugated iron remain unchanged and it is believed that prices will continue firm for the present as the different local warehouses report fairly large stocks on hand and business rather quiet. The demand for paints and oils has fallen off since last month, and prospects for trade in the immediate future are reported rather discouraging—this, in the opinion of dealers being simply the outcome of the disturbing influence of the war on practically all lines of commerce. Local demand for lumber has increased to some extent since the previous review but market conditions generally continue unsatisfactory with prices still below normal.

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. **$1.95.**

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick. $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $30; sand-lime brick, $8.10, King Edward Siding; $7 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20. delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2. $14.50; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; **7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce** flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or **beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 6** in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. **extras $4; N. B. clears $3.45; No. 1 pine lath** $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Quotations withheld.

Steel—(round and square bars) $2.50, base; **twisted and deformed, $2.50; structural sections $2.50 to $3.**

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge

Steel channels and beams, angles and plates—$4.

$2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4. in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 73c per gal. of 9 lbs.

Raw linseed oil—in bbls., 70c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 67c.

MONTREAL PRICES

CEMENT, LIME AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate. 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

(Continued on page 90)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY

LIMITED

BAR STEEL

Warehouse Stocks:
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MEXICAN EAGLE ASPHALT

TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

Purchase MEXICAN EAGLE ASPHALT because:

1—It is more cementitious than other asphalts.
2—Water will not readily injure it.
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4—It has great cohesive strength.
5—It is more ductile and flexible than other asphalts.
6—Shocks will not crack it. It is very malleable.
7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it
9—It has over 99 per cent. bitumen. Purest on the market—therefore free from deleterious matter.
10—It is so constituted that it will not be injured by the heat necessarily applied to melt it for paving operation.

Samples, prices, analyses, etc., on request

The Asphalt and Supply Co., Limited

Sole Canadian Agents for the Mexican Eagle Oil Co. Limited

103-107 Board of Trade Building :: MONTREAL

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from p. .)

Concrete Brick—grey $24, red $24, buff $25, white $47, plain pressed $12 per thousand, all f.o.b. Montreal. Quotations f.o.b. Toronto:—White $52.50, buff $30, grey $27.50, plain pressed $17.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅛-in., $1.75, per ton, delivered.
Sand—95c per ton, car loads, on cars.
Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13c basis; African hemp, 13c; sisal rope 10½c basis. Boiled linseed oil—in barrels, 60c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.
Lime—Grey, 34 cents per bushel; white, 32 cents.
Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, delivered, $13 per cord.
Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.
Gravel—Per yd., delivered, $1.85.

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Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.
Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.
Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.
Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.
Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

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Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

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Paints and Oils—White lead, ground in oil, $8.85 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

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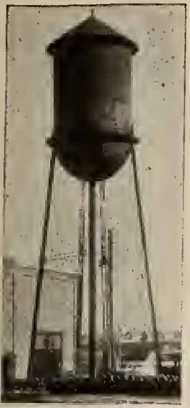
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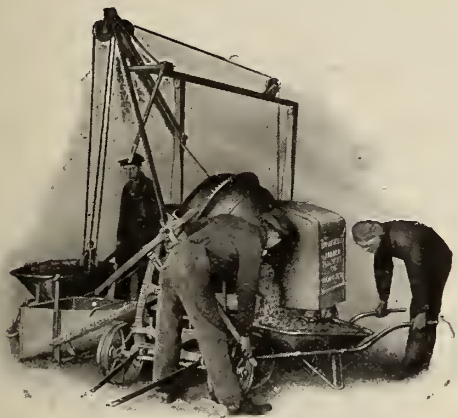

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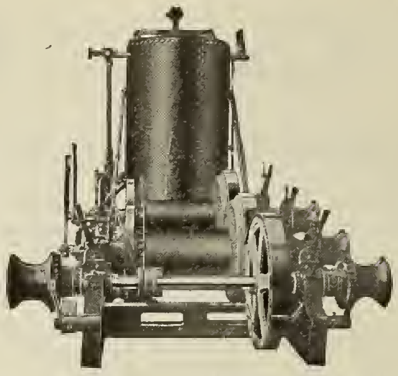

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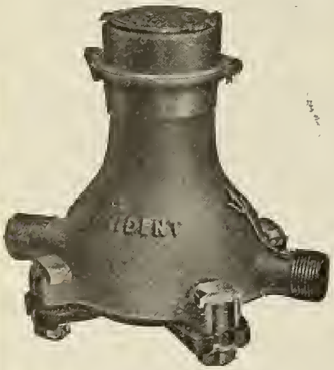

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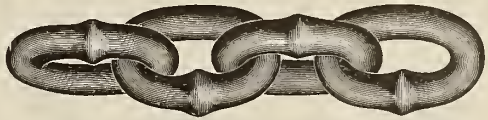

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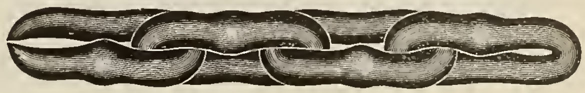

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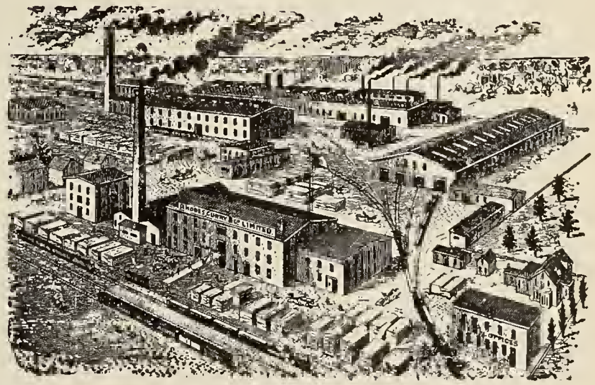

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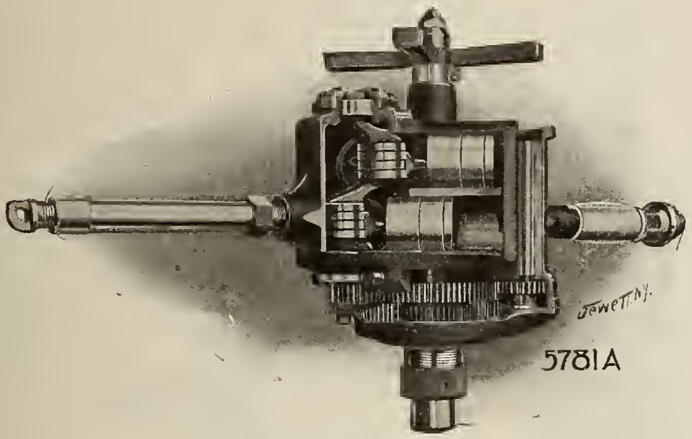

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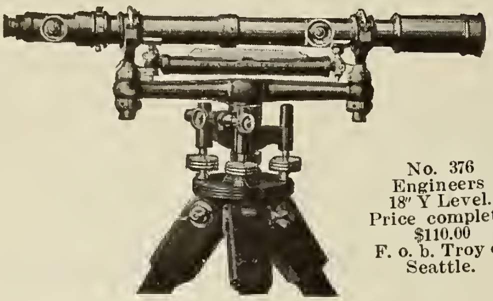


No. 376
Engineers
18" Y Level.
Price complete,
$110.00
F. o. b. Troy or
Seattle.

Gurley Levels

Are universally preferred by Engineers and Surveyors on account of their Accuracy, Stability and Permanency of Adjustment.

Made in five sizes, with telescopes 22, 20, 18, 15 and 6½ inches in length, and priced from $115 to $50, f.o.b. Troy or Seattle.

Write today for specifications and prices

W. & L. E. Gurley, Troy, N. Y.

Makers of Good Instruments Since 1845
Branch Factory - Seattle, Washington

PURE WATER

It is easy to obtain with our plants and apparatus

We design and contract for complete municipal filtration plants of any capacity.

We supply and install apparatus for sterilizing water supplies by the application of calcium hypochlorite.

Literature, Sketches, Estimates and Recommendations Supplied on Request

American Water Softener Co.
1001 Chestnut St., PHILADELPHIA, Pa.

We have no affiliations or working acquirements with any of our competitors.

No. 228
Size:-32 x 44 inches.

No. 681-E Size:-38 x 42 inches
"Swing-Over" Hood for auto repair work.

"Buffalo"

FORGES, BLOWERS, DRILLS

The Standard by which others are judged.

All "Buffalo" Tools combine strength, capacity, small floor space requirements, low power consumption and flexibility to the greatest possible extent. "Buffalo" design and construction are leaders to-day and have been since the inception of the business. Each tool is the best for its particular service. Electrically operated blowers, drills and forges. All sizes for all classes of work. The only efficient variable speed electric motor on the market. Do your work the modern way. Electricity costs less and always responds.

Our catalog No. 179-12 covers the complete line. Every machine is illustrated and described in detail. If you can use a copy write for it.

No. 200-P
Hand Blower
Sizes:-12-14-16
inches.

No. 124-CE Capacity, 1½ inch holes with ½ H. P. motor. Gear guard furnished.

Canadian Buffalo Forge Company, Limited
St. John, Montreal, Toronto, BERLIN, Winnipeg, Vancouver

SAFETY FIRST

ORPEN CONDUIT MANUFACTURING Co of CANADA
MANUFACTURERS OF XCELADUCT AND ORPENITE CONDUITS
HEAD OFFICE
TORONTO ONTARIO

FOR CONDUIT

Xceladuct - Orpenite

Galvanized Conduit made of Easy Bending Spellarized Steel Tube. It is doubly protected against rust by COPPER-PLATING and zinc coating.

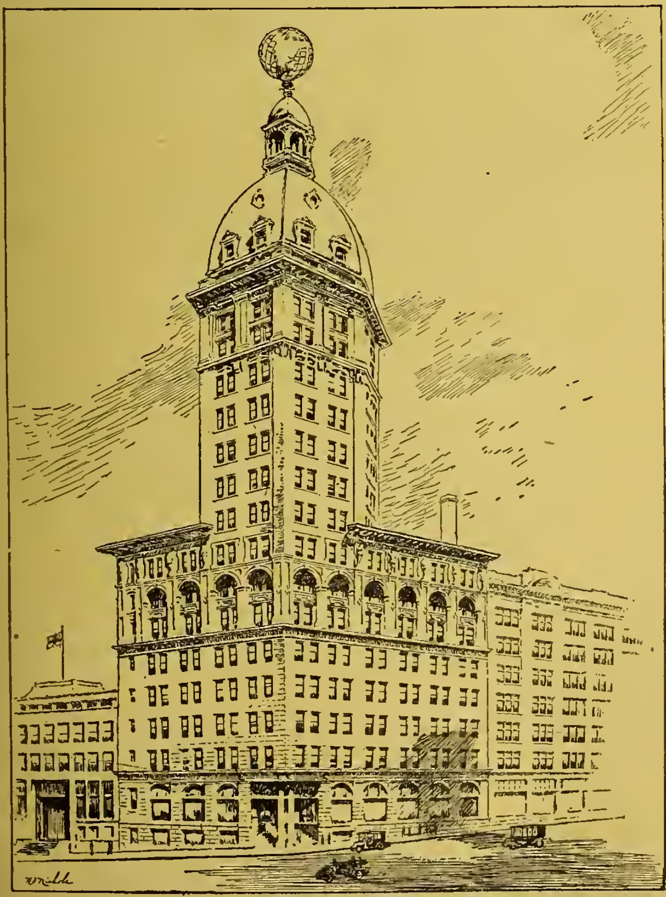
Clean threads and smooth enamelled interior allows rapid fishing.

Enamel Conduit made of Easy Bending Spellarized Steel Tube. It is protected against rust by coatings of special enamel not affected by climatic or temperature conditions. Smooth interior and clean threads.

Let us submit prices and particulars.

Orpen Conduit Company, Limited

TORONTO, ONT.
MONTREAL, QUE.



Across Canada with the

Imperial Wire & Cable Company, Limited

Seventh of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire and Cable Co's. Limited, wires.

This picture shows the

World Building, Vancouver

This building was wired with
"Adanac" Rubber Insulated Wire

Architect: W. T. Whiteway, Vancouver.
Engineer: W. E. Hughes, Vancouver.
Electrical Contractor: J. G. Sutton, San Francisco, Cal.

Address enquiries to our nearest office

Northern Electric Company
LIMITED

Montreal
Halifax
Toronto

Winnipeg
Regina
Calgary

Edmonton
Vancouver
Victoria

Successor to IMPERIAL WIRE & CABLE CO., Limited

Correspondence previously addressed to Imperial Wire & Cable Co., Limited, at 611 C.P.R. Building, Toronto, and 902 Electric Railway Chambers, Winnipeg, should now be sent to Northern Electric Company, Limited, Simcoe St., Toronto, and 599 Henry Ave., Winnipeg.

WIRE ROPE

WIRE ROPE

MANUFACTURED BY

THE DOMINION WIRE ROPE CO., LTD., MONTREAL

"Industrial Works"

Locomotive-Coaling and Wrecking

CRANES

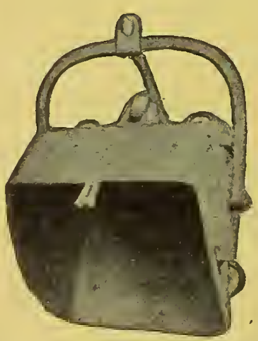
In capacities from

5 to 150 tons

For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.

BUCKETS

For Every Purpose



We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc. in all sizes.

We will gladly furnish full details upon request

We supply CONTRACTORS' EQUIPMENT of all descriptions

F. H. HOPKINS & CO., HEAD OFFICE **MONTREAL**

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

Vol. 28 Toronto, September 2, 1914 No. 35

Contract Record and Engineering Review

ESTABLISHED 1886

MADE IN CANADA
BENT GLASS
THE TORONTO PLATE GLASS IMPORTING CO. LIMITED
TORONTO

GLASS BENDERS
TO THE TRADE

THE TORONTO PLATE GLASS
IMPORTING COMPANY LIMITED
GLASS IMPORTERS AND MANUFACTURERS
91-113 DON ROADWAY, TORONTO

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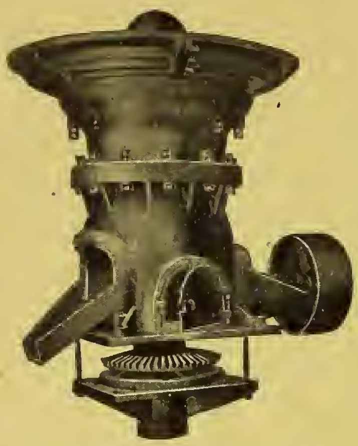


Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

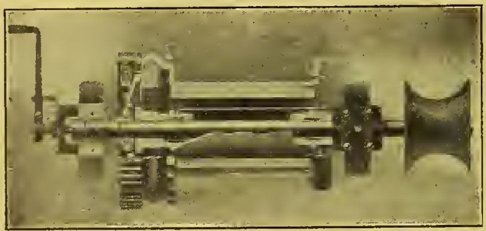
We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson

If You Had to Run It Yourself Which Engine Would You Choose?



Suppose you were engineer of a hoisting engine, operating a clamshell bucket or running a derrick that required fast, continuous work, which would you prefer—an engine with an easy operating friction; easy to throw in, easy to hold in, or one with a friction that required violent effort to throw it in and equally violent effort to hold it there? That's the difference between

"AMERICAN" EXPANSIVE TYPE FRICTIONS

and the cone type universally sold with other engines—a type in which it is necessary to push the whole drum across the shaft and hold it there by main strength. The strength and weight of the operator and the push of the thrust screw have to do the whole job.

"AMERICAN" Friction supplements the push of the thrust screw with the toggle action of the friction; this produces a thrust several times greater than the unassisted push of the thrust screw.

An untired operator is bound to get better results than one fagged out by needless tussling with a cumbersome machine.

The cool running "AMERICAN" friction; quick, positive, easy to operate, will save you money. Make us prove it.

—MADE BY—

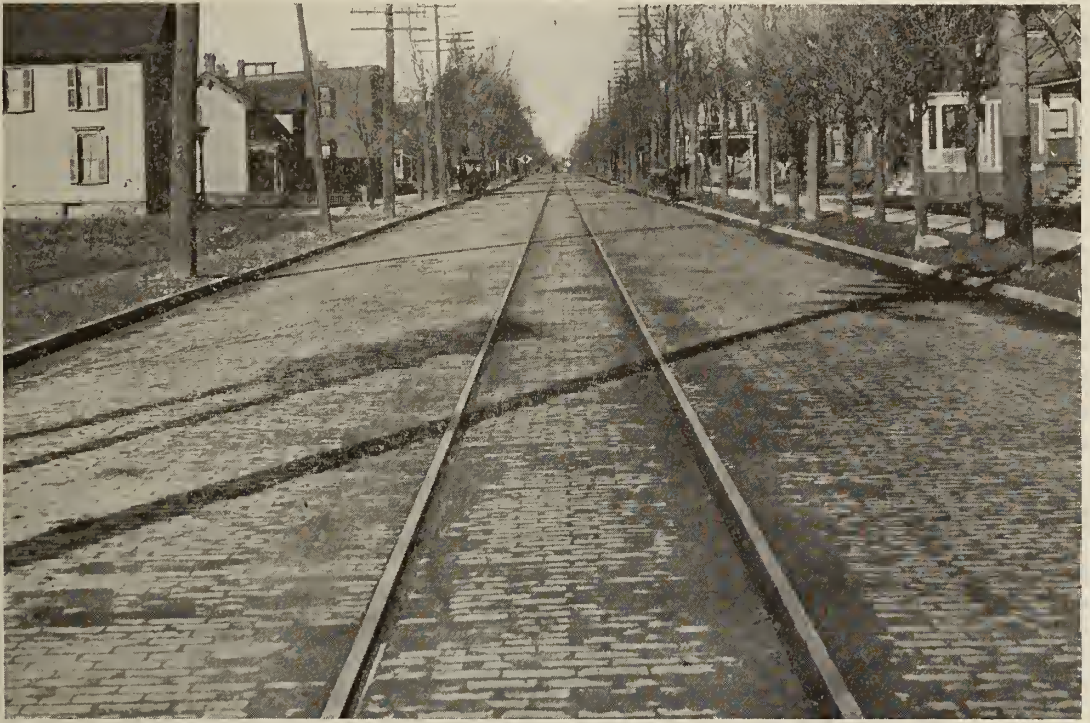
AMERICAN HOIST & DERRICK CO.

ST. PAUL, MINN.

SOLD BY—

General Supply Co., of Canada, Ltd., Montreal, Ottawa, Toronto, Canada.
Gorman, Clancey & Grindley, Edmonton, Alta., and Nelson, B.C.
Stuart Machinery Co., Limited, Winnipeg, Man.
Vancouver Machinery Depot, Limited, Vancouver, B.C.

Vandervoort Street, North Tonawanda, N. Y.
Paved in 1909 with Bessemer Block



Building Good Streets

Many cities have tried the many patent pavements on the market only to eventually use Bessemer Block. The reason is that patent compositions are uncertain and rely too much on the personal supervision of preparation and laying.

Bessemer Wire-Cut-Lug Block

is made from a high-grade shale vitrified into a tough, durable substance. Wears longer than any other known road-paving—four inches of actual wearing surface. Lowest maintenance cost. Offers least traction resistance. Ideal for heavy loads. No mud or greasiness. Dustless and sanitary. Real estate values go up on a Bessemer Block road—the road that is there long after the long-time bond is paid.

Ask us for full information and details of Bessemer paved roads that have been giving excellent service for years past.

We guarantee quick delivery on all orders

Bessemer Limestone Company

Manufacturers of Bessemer Repressed and Dunn Wire-Cut-Lug Paving Block

Youngstown ∴ Ohio

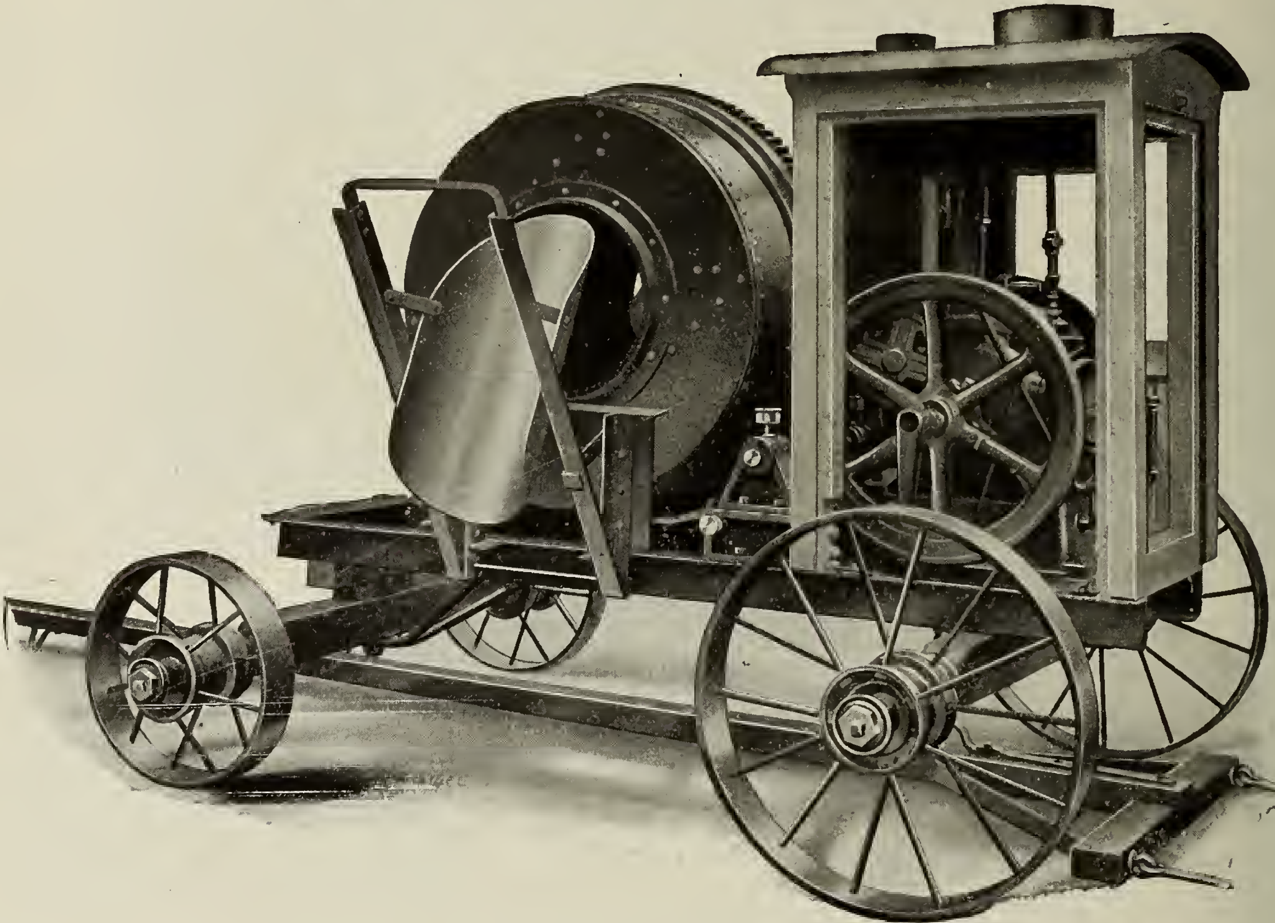
CANADIAN AGENTS { G. W. Essery, 47 Yonge Street Arcade Building, Toronto, Ontario
Stinson-Reeb Builders Supply Co., Montreal, Quebec

SAFETY AND SPEED

IN CONCRETE CONSTRUCTION

The Chicago Mixer

is safe from breakdowns and speedy in mixing.



Special Points

Speed of Mix— Rapidity of Dump—Lasting Qualities— Loader Construction—
Ease of Operation—General Handiness, Etc.

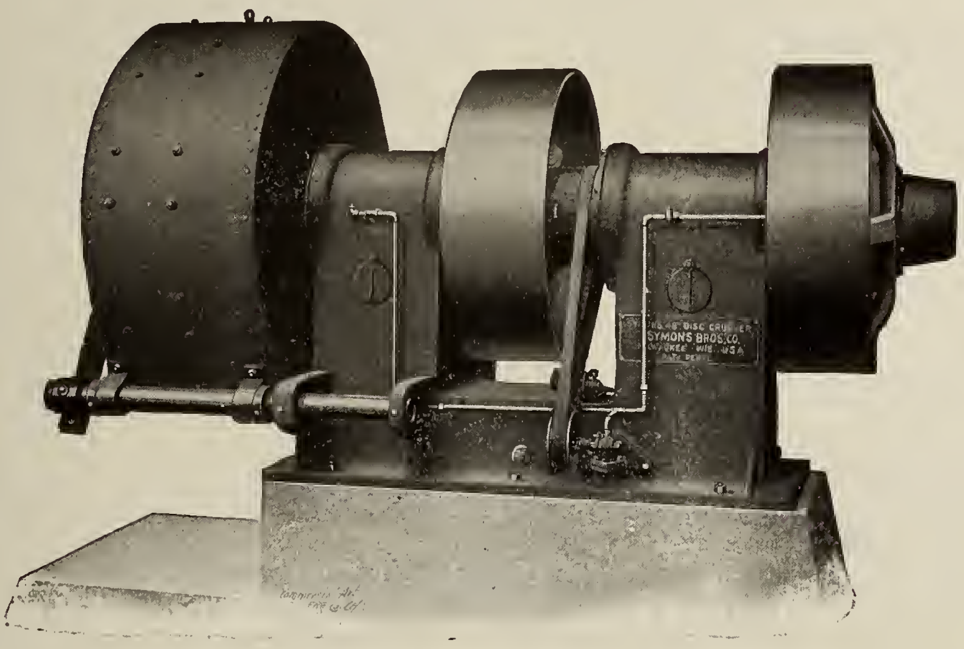
MADE IN MONTREAL — CARRIED IN STOCK.

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

Symons
Disc Crushers

MEAN LARGE CAPACITY OF SMALL SIZED STONE



Will take rejections, screened or unscreened, from standard Gyratory crushers and reduce same rapidly at one operation to ¾ inch size and less.

Can be quickly adjusted to make any standard size of product desired—¼ inch to 2½ inches.

MADE IN CANADA — SEND FOR CATALOGUE.

Mussens Limited

MONTREAL, 318 St. James Street
WINNIPEG, 259-261 Stanley Street
TORONTO, 155 West Richmond St.
CALGARY, 10th Ave. and 3rd St. East
COBALT, Opp. Right of Way Mine
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
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Hull Iron & Steel Foundries

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Canadian Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd.
Jenckes Machine Company

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Weeks, Arthur L.

Architects' Instruments
Stanley Co., W. F.
W. & L. E. Gurley.

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Aikenhead Architectural Iron Works
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Asphalt & Supply Co.
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Dominion Bridge Co.
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Dietrich Limited
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Foundation Company, Limited
Wells & Gray

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Golden Anderson Valve Co.

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Roelofson Elevator Works
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Rock & Power Machinery
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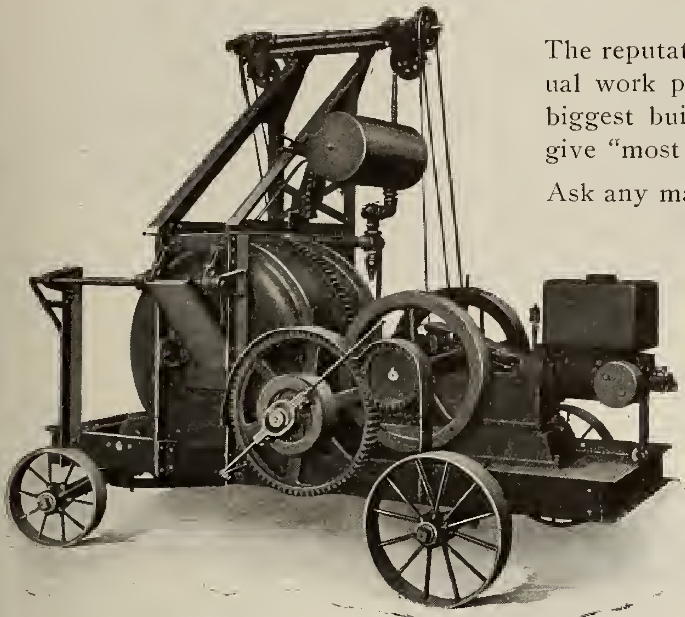
Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 12)

"Most Mixing - Least Fixing"



M-C Rail-Track Mixer with Elevated Side Loader, operated by Gasoline Engine

The reputation of the M-C Rail Track Line is based upon actual work performed. Contractors who construct the world's biggest buildings insist upon machines which are known to give "most mixing" with "least fixing."

Ask any man who owns an

M-C Rail-Track Mixer

what he thinks of it. He best can tell you what the machine will do. Building mixers are ¼, 1/3, ½, ¾ and 1 cu. yd. of concrete per batch in size.

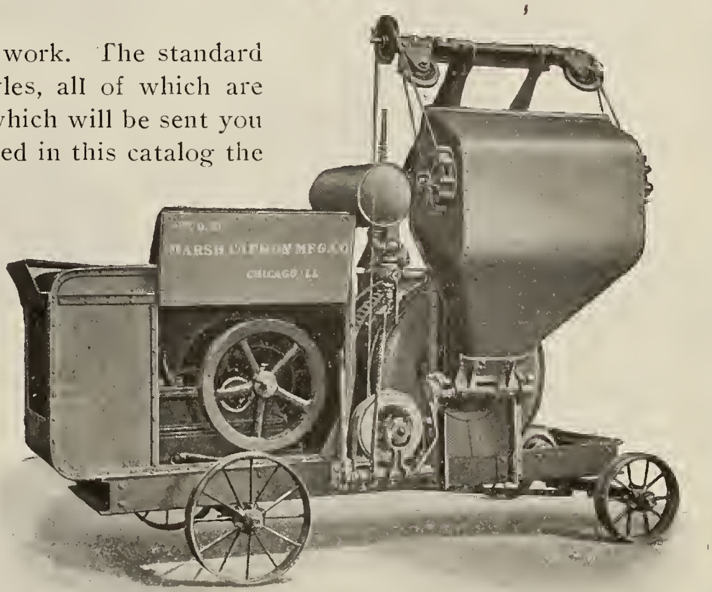
Power: Steam, Gasoline or Electric Motor.

M-C RAIL-TRACK MIXERS

are built for every kind of cement construction work. The standard line for building contractors includes many styles, all of which are illustrated in a beautiful new catalog, a copy of which will be sent you post paid on request. There is also fully described in this catalog the

M-C RAIL-TRACK PAVER

which is the wonder of all who have seen it at work. This paving mixer has all the good features of the M-C standard line, to which are added traction features which include shock absorbers when travelling, two speeds ahead and one reverse, extra large strong wheels and strong brakes. It runs like an auto truck or a traction engine, up hill or down, safely, without the need of horses. The machine is easily controlled by one man.



M-C Rail-Track Mixer showing Steel House Provided for Gasoline Engine and Elevated Side Loader

Be sure to send for the new catalog

CANADIAN FAIRBANKS-MORSE CO., Ltd.

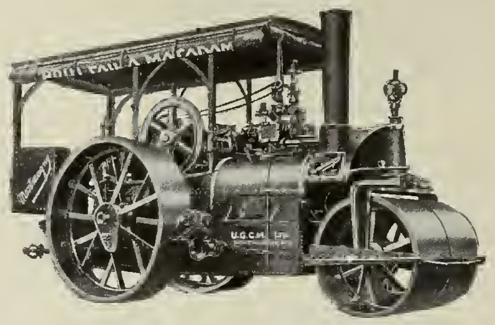
Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

Manufactured by

Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

Head Office and Works

"Montmagny" Modern Road Builders



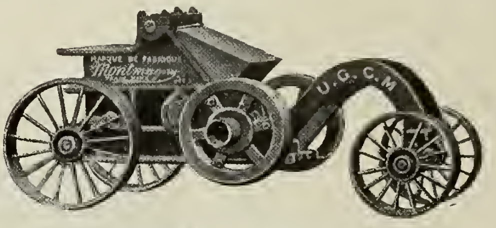
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"



"Montmagny" Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

"Montmagny" Portable Steel Bin.

Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue

General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

CERESIT

A Constantly Growing Demand is One Excellent Sign of Success.

The sales of Ceresit during the first six months of 1914 exceeded the sales during the same period of 1913 by 23%. To those confronted by problems of waterproofing this is very significant.

CERESIT
TRADE MARK

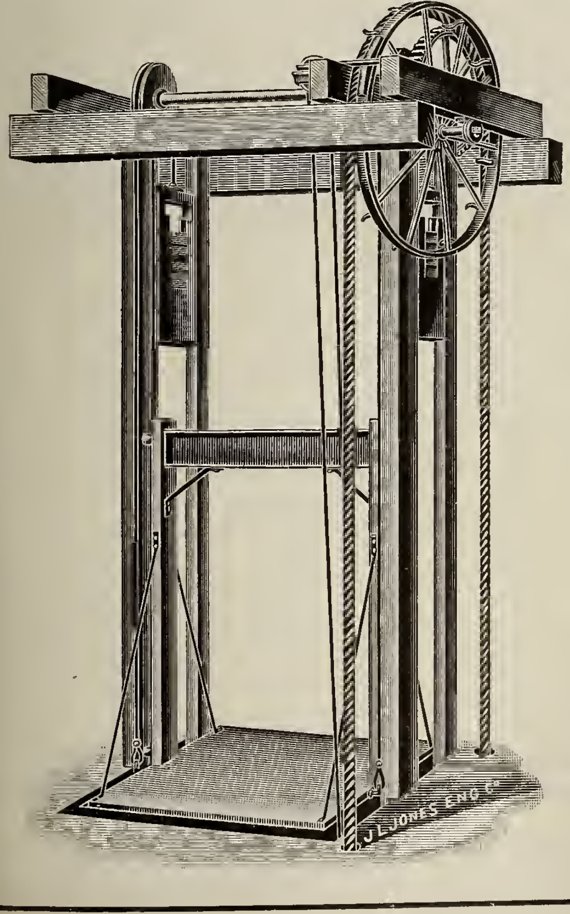
The Dependable Waterproofer for Cement

Ceresit has been on the market for many years. It has survived the years of doubt caused by the many ill-considered waterproofings which swamped the market and failed to waterproof. The sales of Ceresit have grown steadily. and as the unvarying reports of successful application come in, they grow faster and faster.

You can depend upon Ceresit doing thoroughly the things we claim for it in our "Book of Evidence." Write for your copy.

Ceresit Waterproofing Company
913 Westminster Bldg., CHICAGO
FACTORIES—Chicago, Unna, Germany: London, Paris, Vienna, Warsaw

LIST OF DEALERS—W. B. Poucher, Edmonton, Alta.; E. G. Cullen, Vancouver, B.C.; Walkers, Ltd., Winnipeg, Man.; R. deB. Carrite, St. John, N.B.; W. K. Macdonald Co., Toronto, Ont.; McLelland Peters Co., 305 Read Bldg., Montreal; The Whitlock-Riddell Co., Moose Jaw, Sask.; Brown & Chapman, Regina, Sask.; MacKenzie & Thayer, Ltd., Saskatoon, Sask.; N. G. DeHaas, Sault St. Marie, Ont.


J. L. JONES ENG. Co.

Turnbull Elevators

Passenger
Freight
Hand Power
Dumb Waiters

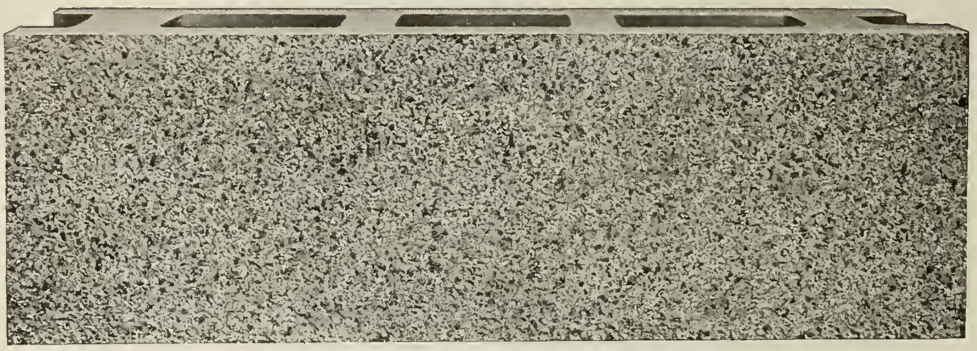
The Turnbull Elevator Mfg. Co.
Toronto, Ont.

Zagelmeyer System

OF CASTING

Hollow Cement Building Blocks

With Granite Faces



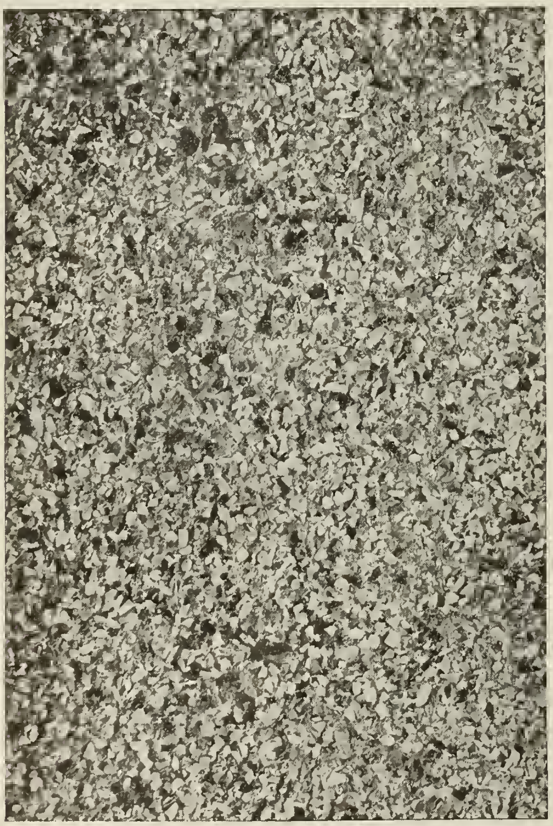
8 x 8 x 24 inch Granite Smooth Face Block

They cost less

They sell for more

You sell more of them

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



Enlarged View of Granite Smooth Facing

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold or moisture.

8 x 8 x 24 inch Granite Rock Face Block

Send us fifty cents and we will send, freight prepaid, to any point in Ontario, one of our granite-faced blocks. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

MR. BLOCK MAKER:—

What show will you have if your competitor secures the exclusive right for this system in your city?

MR. CONTRACTOR:—

Get into a business that is protected. Then you will make money.

Send for catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Canadian Zagelmeyer Co.
Limited

298 Howard Ave., Windsor, Ontario

Reporters Wanted

Appreciating the increased demand that will be created for building and engineering reports, we are adding to our staff and increasing its efficiency all along the line. Applications will therefore be received immediately from your district. Appointments will be made at once.

DUTIES

To report on building and engineering projects, contemplated, their progress, and details of the material and equipment required.

TERRITORY

A definite territory will be assigned to each new man. This will not effect existing arrangements with our staff reporters.

TERMS

Commission basis only. Each report valued on its merits according to our schedule of payment. Accounts paid monthly.

QUALIFICATIONS

State briefly what experience you have had and give details of your present or past connections.

Write immediately.

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Canadian Sirocco Company
Inglis Company, John
Jenckes Machine Company
Laurie & Lamb
Leonard & Sons, E.
McDougall Caledonian Iron Wks.
Mussens Limited
Rock & Power Machinery

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Campbell, R.
Cape Company, E. G. M.
Chipman & Power.
Dominion Engineering & Inspection Company
Farmer, John T.
Galt Engineering Co., John
Hamilton, S. W.
Lea & Ferguson
Mitchell, C. H.
McDougall, Geo. K.
Pullar, H. B.
Tyrrell, H. G.

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Austin Drainage Excavator Company, F. C.
Brown Hoisting Machinery Co.
Municipal Engineering & Contracting Company
Parsons Company, G. W.

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Canadian Buffalo Forge Co.
Sheldons Limited

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Pedlar People Limited

Fans
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Hope & Sons, Henry
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Lecky & Collis

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Consumers Gas Company

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Wayvell Chappell & Co.

Floor and Wall Tile
Frontenac Floor & Wall Tile Co.

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Canadian Buffalo Forge Co.
Sheldons Limited
Canadian Sirocco Co.

Forgings
Canadian Billings & Spencer, Ltd.

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Goold, Shapley & Muir Co.

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Luxfer Prism Company
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Browning Company
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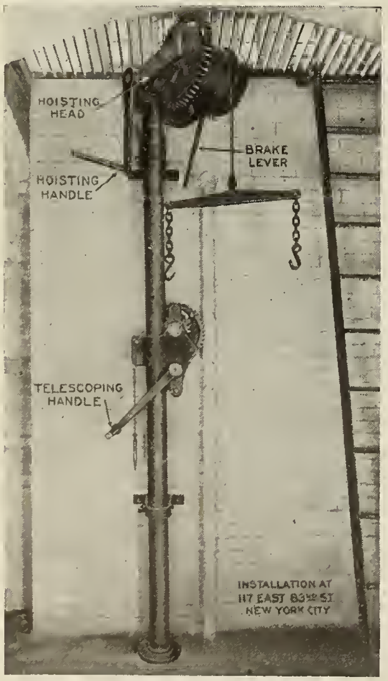
Hopkins & Co., F. H.
Lecky & Collis
Marsh & Henthorn
Morris Hoist & Crane Co., Herbert.
Mussens Limited
Rock and Power Machinery
Royce Limited

(Continued on Page 14)

G & G TELESCOPIC HOIST (PATENTED)

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.



Compact—easy to erect. Takes up no room in basement.

1.—It is telescopic—no part showing above sidewalk when not in use.
2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.
3.—Simple in construction and absolutely rigid when erected.
4.—It is made of strongest and most durable material.
5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.
6.—A powerful ratchet device is provided with both handles above mentioned.
7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.

Gillis & Geoghegan
549 West Broadway
New York

Hoisting head revolves. Can is deposited on Sidewalk without lifting.

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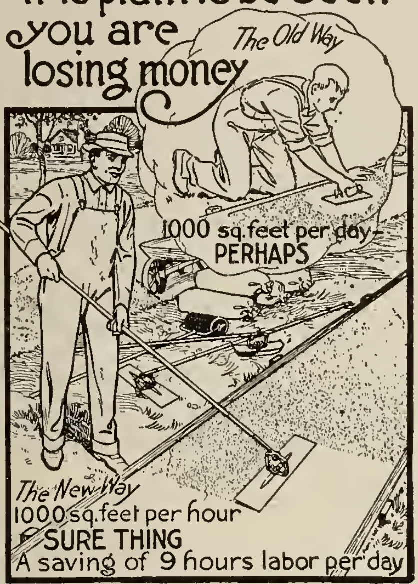
Montreal

W. T. Grose
Agents for Manitoba, Saskatchewan, Alberta
Winnipeg

Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

If you are not using
"ABRAM"
TOOLS
It is plain to be seen
you are
losing money



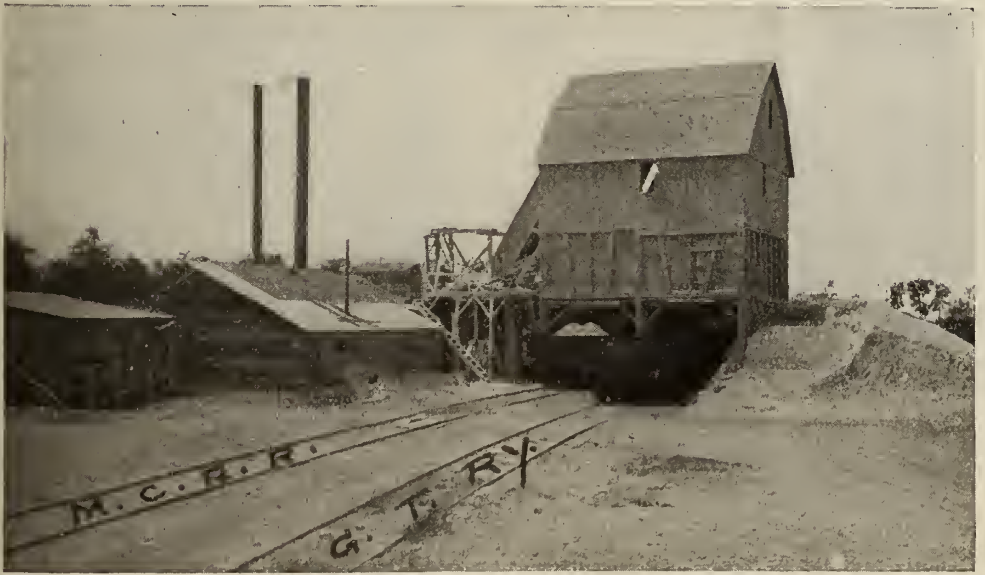
Abram Cement Tool Co.,
Windsor, Ontario

A STEAM SEPARATOR

of the receiver type is a difficult piece of plate work to make absolutely and permanently tight. That is the reason why we developed our Welded Separator—not a single rivet in its construction, every joint and seam being a perfect weld. The shell is lap welded, the heads are set in by our patented Line Weld method and the necks are attached by our patented Interlock method.

PITTSBURGH VALVE,
FOUNDRY & CONSTRUCTION CO.
PITTSBURGH, PA.
ATWOOD ENGINEERS FOUNDERS MACHINISTS ATWOOD

Macadam Roads



must be built of a
Tough Stone
that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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Northern Crane Works

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Kerr Engine Company

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Morris Crane & Hoist Co., Herbert

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Jamieson Lime Company
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Plate Glass
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Pilkington Bros.

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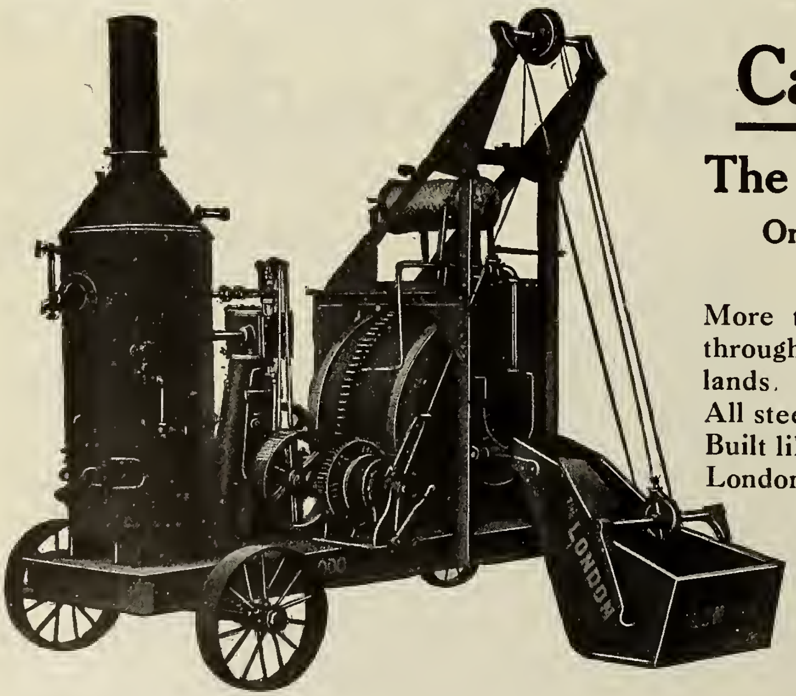

Canada's Choice

The London Concrete Mixer

Once a specialty—now a question of our output capacity

More than 1200 London mixers are in use throughout Canada to-day—also many in foreign lands. The mixer itself supplies the reason. All steel construction with few working parts. Built like a battleship in its points of resistance. London Concrete mixers are made in twenty-three different sizes with any equipment. Our manufactures comprise a complete line of concrete machinery and cement working tools.

We are the Largest Manufacturers of Concrete Machinery in Canada

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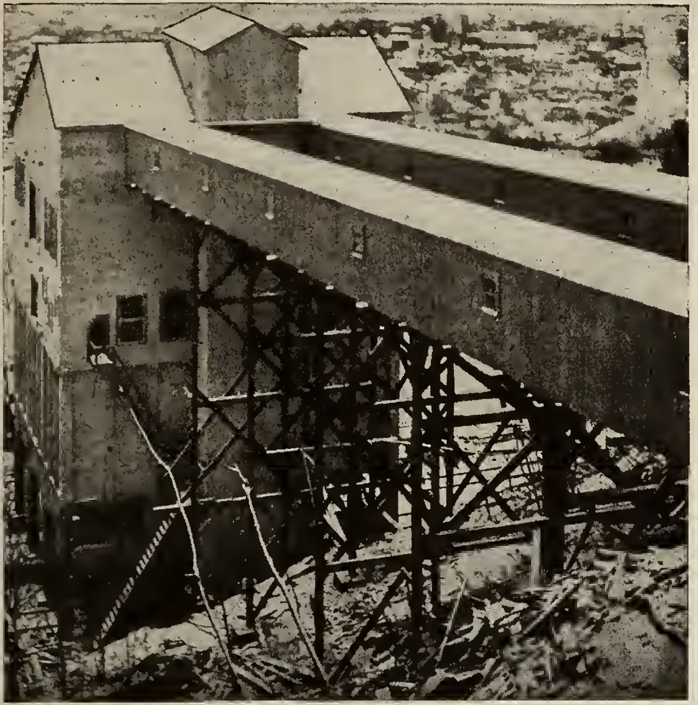

Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario

Traders' Bank of Canada, Toronto
Structural steel painted with "Superior Graphite Paint"

PROTECTION
for ALL kinds
of surfaces
Guaranteed
by using
"SUPERIOR
GRAPHITE
PAINT"

Penstocks
Developing 96,000 horse power, painted with "Superior Penstock Paints."

The most economical paint that can be used when maintenance cost is considered, for

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STEEL CARS
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TANKS
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TROLLEY POLES

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Made in U. S. A. by DETROIT GRAPHITE CO., Detroit, Mich.

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  - Rock & Power Machinery

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  - Manitoba Bridge & Iron Works
  - Pittsburgh-DesMoines Steel Co.
  - Walsh Plate & Structural Works

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  - Pittsburgh Valve, Foundry and Construction Company
  - Sheldons Limited

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  - Gray Mfg. & Machine Co.

- Steel Trucks
  - Gray Mfg. & Machine Co.

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  - Sturtevant Co. of Can. Ltd. B. F.

- Steam Turbines
  - British Mfrs. Assn. of Canada
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  - McDougall Caledonian Iron Wks.
  - Sturtevant Co. of Can. Ltd. B. F.

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  - Dominion Iron & Steel Co.
  - Steel & Radiation, Ltd.

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  - Canadian Steel Products Co.

- Steel Boxes
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  - Canadian Allis-Chalmers, Ltd.
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  - DesMoines Bridge & Iron Co.
  - Dominion Bridge Company
  - Hamilton Bridge Works Co.
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  - Inglis, John
  - Jenckes Machine Co.
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  - Marsh & Henthorn
  - McDougall Caledonian Iron Wks.
  - Ontario Wind Eng. & Pump Co.
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  - Greening Wire Co., B.

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Tarvia

Preserves Roads Prevents Dust~

St. Viateur Street, Outremont, Quebec. Constructed with Tarvia Modern Pavement.

The maintenance question solved—

Ordinary macadam roadways, which under modern traffic cost from 15 per cent. to 50 per cent. of their original outlay for annual maintenance and occasional rebuilding, are a waste of money.

It is rare that a typical stretch of plain macadam receiving much traffic can be kept in good order for five years without having an expenditure for maintenance at least equal to the original cost.

How much better it is to build roads that will stand modern traffic, like St. Viateur Street in Outremont, P.Q. This macadam road was bonded with Tarvia, a dense, tough, viscid, coal tar binder.

The total construction cost was only a trifle more than that of plain macadam, but it is being maintained so cheaply that the original extra expense for Tarvia is more than justified.

For three years the maintenance expense was nil. In the fourth year a light surface coat of "Tarvia B" and a little coarse, sharp sand, at a cost of not more than a few cents a yard, made the original surface dustless and compensated for all the wear of the three years. An occasional coat of "Tarvia B" will make the road last indefinitely.

Streets constructed and maintained with Tarvia retain their smooth and even contour. There is no mud and no dust. Frost and rain torrents do not hurt the surface. Automobile traffic does not disrupt the road. The good looks and easy traction of a Tarvia street will tend to increase adjacent property values, and the Tarvia treatment is therefore a good investment in that way as well as in the net reduction of road expenses.

Booklets on request.

THE PATERSON MANUFACTURING COMPANY, LIMITED
MONTREAL TORONTO WINNIPEG VANCOUVER

THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
ST. JOHN, N. B. HALIFAX, N. S. SYDNEY, N. S.

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Aikenhead Hardware Company	103
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American Hoist & Derrick Co.	2
American Water Softener Company	98
Anderson & Co., Limited, George	80
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Performs all Slack Cable-way Operations

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Other Machines

The above cut demonstrates how the operator may discharge the load rapidly. By releasing the load line drum on the hoist as soon as the excavator has come to the stop the bucket swings to a perpendicular position.

Here is shown how the operator may control the discharge by holding in the slack on the load line.

This operation is of great value to the operators of gravel plants where the material has to be washed and water is short.

The lower cut shows an individual and distinct operation. The material being transmitted by gravity and discharged at a given point near the anchor end of the track cable-way.

Almost a half circle may be covered with one setting of the power and mast.

Operates in pit or stream.

Maximum Production—Minimum Cost.

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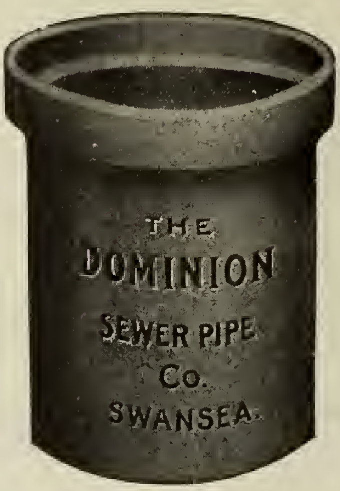

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Type O Thew on Road Grading

The use of a Thew Automatic Steam Shovel will effect an immense saving in labor.

The output is limited only by the facilities provided to cart it away.

The Type O Thew shown in the cut loaded 1,965 cu. yds. in 7 ten-hour days.

Another Type O Thew in a 6 ft. cut averaged 578 cu. yds. during the month of April.

Another Type O Thew in a gravel pit loaded 5,182 cu. yds. in 7½ ten-hour days—an average of 76 cu. yds. per hour.

Another Type O in a 15-inch cut averaged 314 lineal feet, amounting to 292 cu. yds. per 9-hour day for 23 days.

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High Grade Salt Glazed Vitrified Sewer Pipes and connections are a specialty with us. We also manufacture culvert pipes, inverts, flue linings, stove linings, fire bricks, locomotive blocks, gulley traps, range bricks, cupola linings, wall coping and all kinds of vitrified and fire clay goods. Prompt shipments on all goods.

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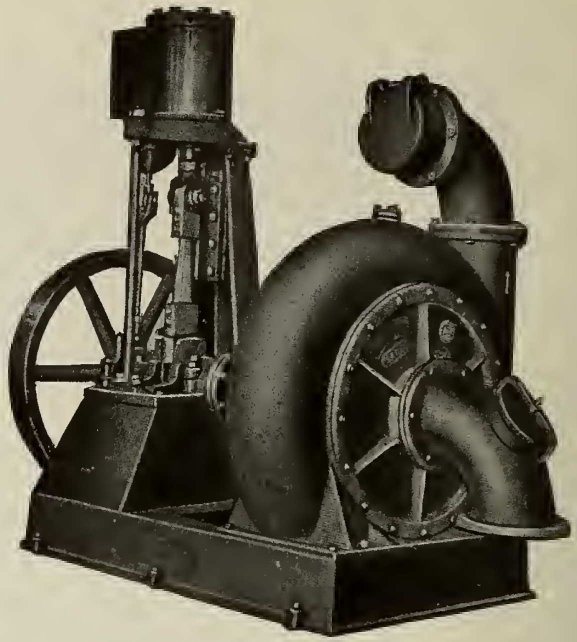

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Complete Hydraulic Dredging Machinery
Centrifugal and Turbine Pumps for Every Service

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Results of 3,000 Tests
on Rail-Steel Reinforcing Bars

The American Society for Testing Materials appointed a Committee to investigate the merits of rail steel reinforcing bars.

Under the direction of Professor W. K. Hatt, of Purdue University, 2,036 samples were collected between September, 1912, and February, 1913.

Upon these samples 2,983 tests were made. The samples were gathered unexpectedly from six mills and represented true working conditions.

In Professor Hatt's report to the Society the following oustanding features are commended upon:—

1. The rail steel **showed an excess ductility** for its strength above the usual grades of steel.

2. 97 per cent. of the plain and deformed bars under ¾-inch bent cold to 180 degrees, and 97.6 per cent. of the bars ¾-inch and over bent cold to 90 degrees.

3. **The material showed remarkable uniformity,** as 80 per cent. of the bars did not vary more than 12 per cent. from the mean tensile strength. (Professor Hatt says that the variability of high carbon billet steel used for reinforcing bars should be known for comparison, but unfortunately no such data was available). The veriability of 12 per cent. in the mean corresponds favorably with the specification limits of from 55,000 to 70,000 pounds per square inch set for the tensile strength of structural steel reinforcing.

4. Professor Hatt says that it was apparent that the process of manufacture had **raised the mechanical quality of the material.** In this connection, it must be remembered that the material to begin with was of the best, as rails, of course, are always made of the highest grade steel.

We would be pleased to submit a complete copy of Professor Hatt's report and to go into the whole subject in great detail with any engineer, architect or contractor who may desire further information.

Burlington Steel Co., Limited, Hamilton

Manufacturers of Rounds, Squares, Flats, Twisted Squares, Angles, Channels
T-Bars, Ovals, Half Ovals, Half Rounds, Bands and Special Sections

A Product Without a Peer

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LAST FOREVER.

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STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application

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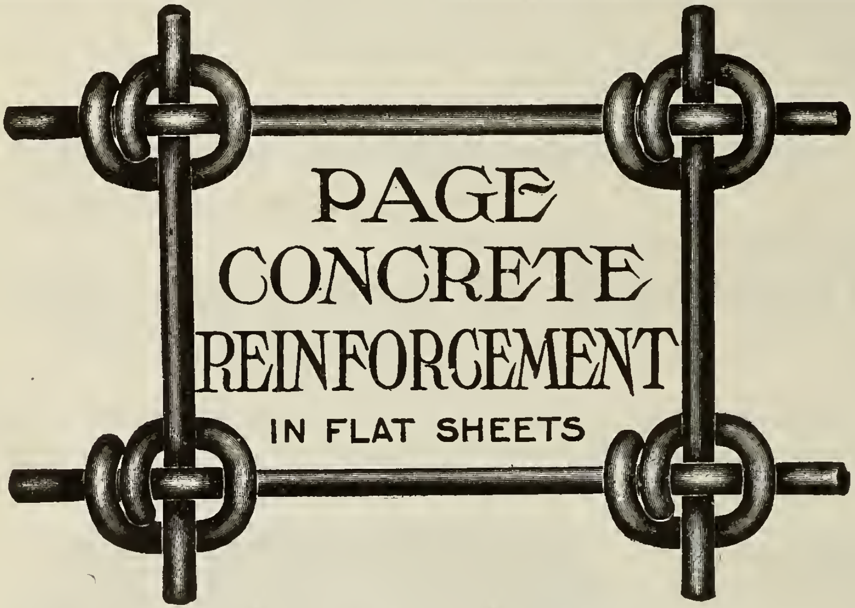
Drop Forged Drift Pins
fit right and wear well

Welland, Ontario



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We are the originators of this wire reinforcement in flat sheets, and it is coming into universal use wherever introduced. We have supplied many carloads of it this season.

Can be supplied in rolls if preferred.

The standard mesh for road pavement is 6 x 12 inches; for bridges and building floors, the standard is 3 x 6 inches. All sheets 4 feet wide, and any length specified that can be loaded in cars.

PRICES per 100 sq. ft. delivered—6 x 12 mesh $0.75—3 x 6 mesh $2.25

Samples will be sent upon request.

The Page Wire Fence Company, Ltd., **Walkerville Ontario**

Branches:— Toronto Montreal St. John, N. B.

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STEEL FLORETYLE

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We carry in stock **Locomotives of all types, Flat Cars, Center, Side** and **Air Dump Cars, Box** and **Gondola Cars.** Can make Prompt Deliveries. Prices Low.

Write for Specifications and Quotations on anything you need.

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$45. GARROW

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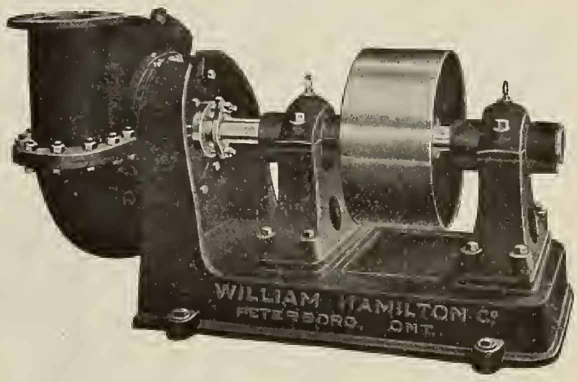
The great feature of this new light is strength and simplicity. The light is constructed of steel assembled by the Oxyacetylene Welding Process and consists of three parts. It is made to stand the roughest handling by unskilled labor without injury. A distinct advantage of the Garrow Light is its use in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame.

$45.00 F. O. B. Sudbury

The
Sudbury Construction & Machinery Co., Ltd.
Sudbury, Ont.



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These pumps have been specially designed for contractors' use. They are made for belt, direct engine or motor drive.

They have special features not found in any other pumps, notably the horizontally split shell and the wide spacing between pulley and bearings.

They are built in all sizes from 2-in. to 14-in. discharge.

Ask for pump bulletin.

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In the Royal Bank Building we laid all the floor arches and partition. The arches at the rate of four floors a week and the partitions at the rate of 5 floors a week of Gypsum Block.

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Gypsum Blocks

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We build all kind of Cranes for

HAND POWER
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Brickmaking Machinery
Complete Outfits for Brickmakers

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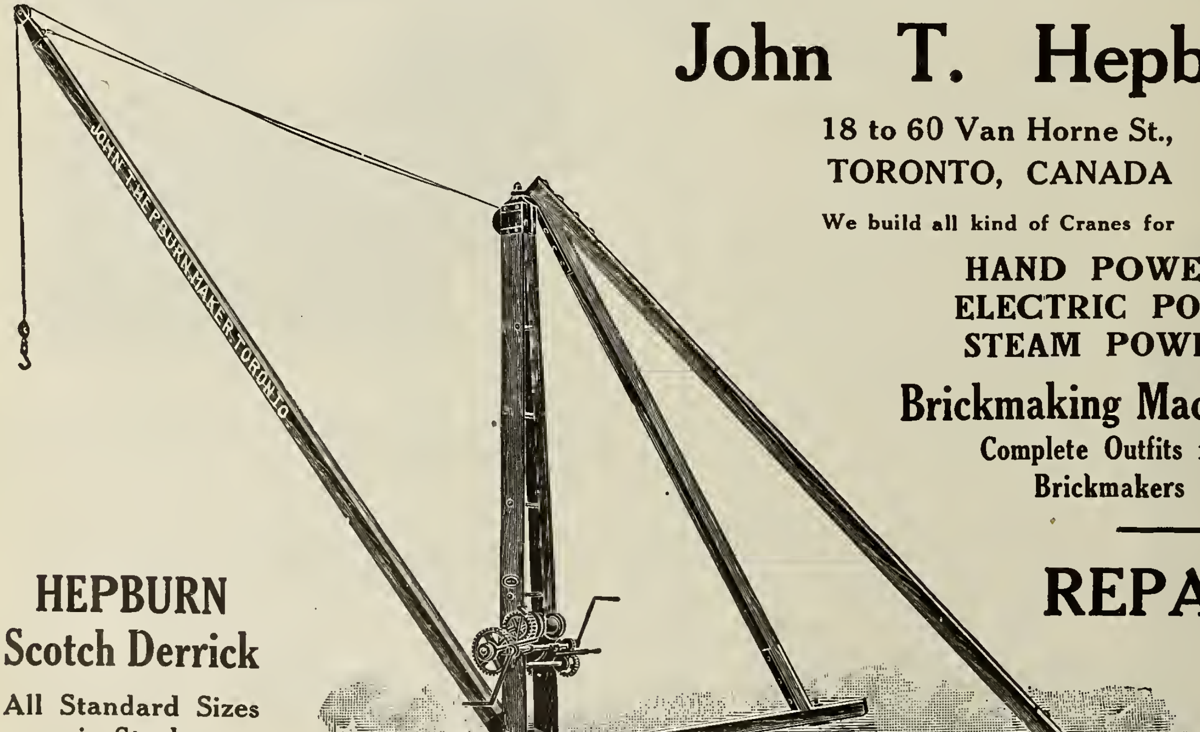
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from 1/2 Ton
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Shoot the Whole Face—Not by "Benches"

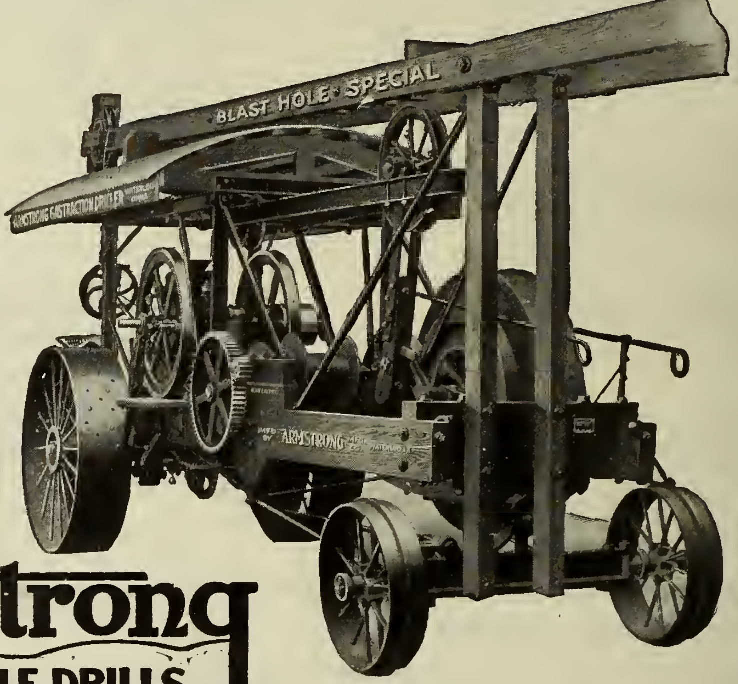
Break up the rock for easier handling.

Cut down the cost of powder per ton of rock.

Stop your shovel and crew *once,* not a half dozen times.

Save on your track laying expense.

Reduce the liability of damage and accident.



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BUILT FOR SERVICE SINCE 1867

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One Shot

We guarantee the Special "Armstrong Blast Hole Drill" to drill more footage in a given time than any other cable drill.

We have data on six months' tests where, in competition, it proved 53% more efficient.

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It Tells How!

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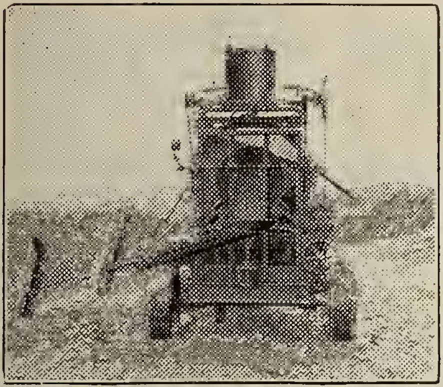
Six-Inch Concrete

Date	Sq. Yd. Daily	Total Sq. Yd.	Date	Sq. Yd. Daily	Total Sq. Yd.
May 13th	1360	1360	May 17th (Sunday)	....	....
14th	1227	2587	18th	1340	6663
15th	1436	4023	19th	1365	8029
16th	1300	5323	20th	1350	9379

Average square yards 1340. Average cubic yards 223½.

This is record of contract work on pavement construction and is signed and sworn to by the inspectors for the city of Chicago.



Features of the Austin Cube Paver

Non-tilting type, material charged at one end and discharged at the other.

Booms, fifteen to twenty-five feet in length, swing at radius of 80 deg. each way.

Machine has ample reserve power.

Built with or without self-traction

All levers within easy reach.

Door at discharge end prevents slopping of concrete.

Bucket or skip drops close to the ground facilitating easy and rapid loading directly into the charging hopper from wheelbarrows.

Machine is set up high enough from the ground so that carts can be backed directly under the discharge spout when it is not desirable to use the boom.

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We also build

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to support them.

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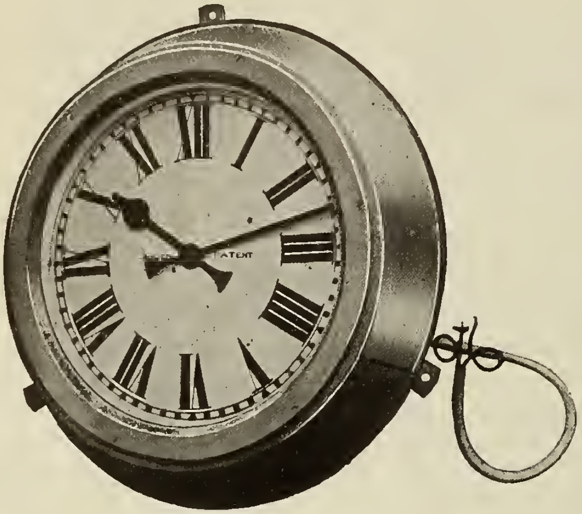

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"Always Cushioned in Opening and Closing"

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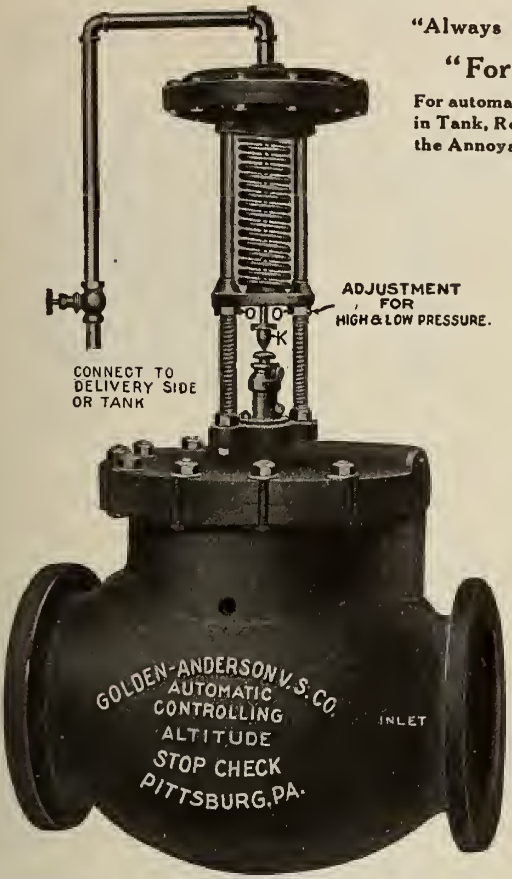
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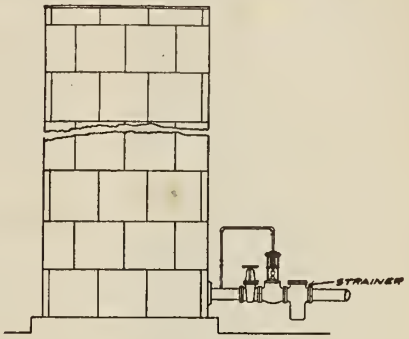

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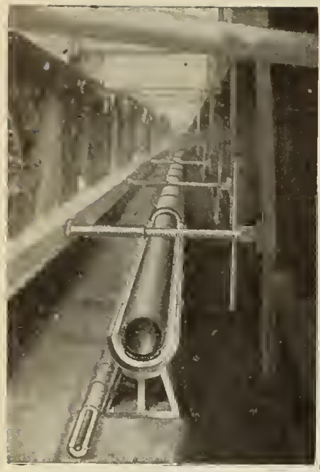

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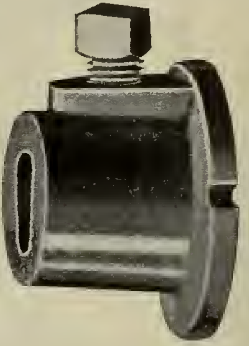

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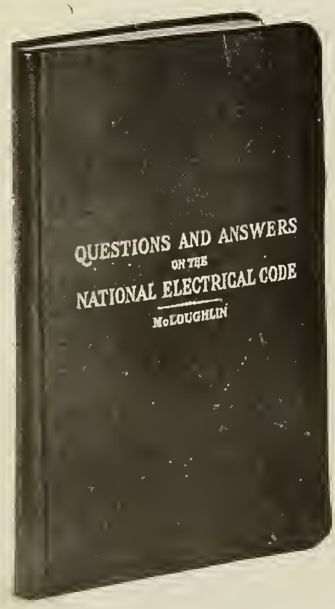

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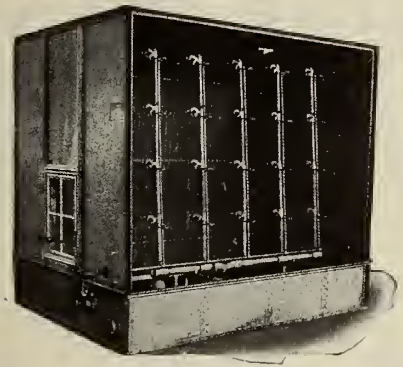

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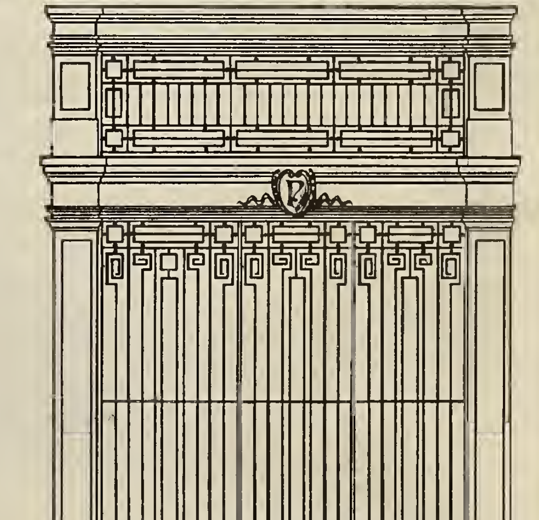

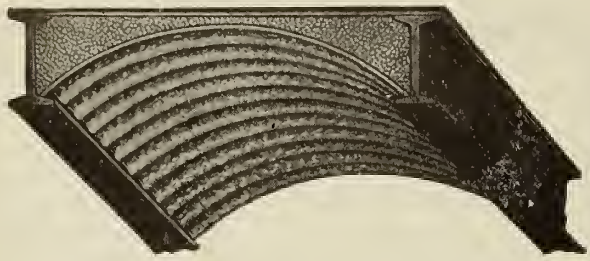

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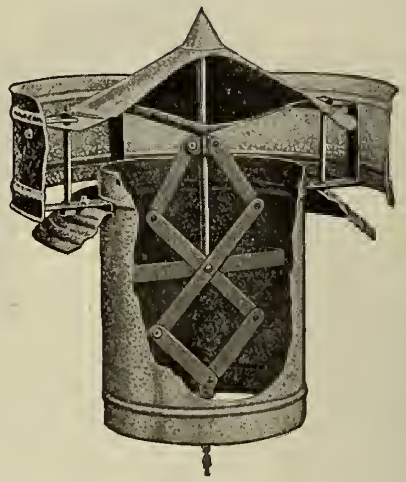

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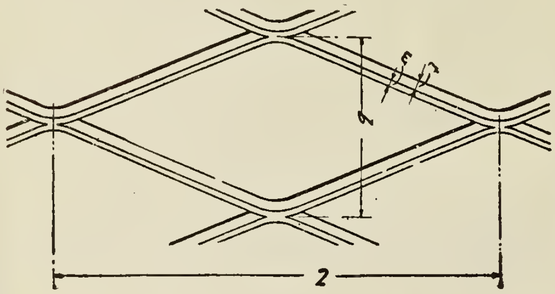

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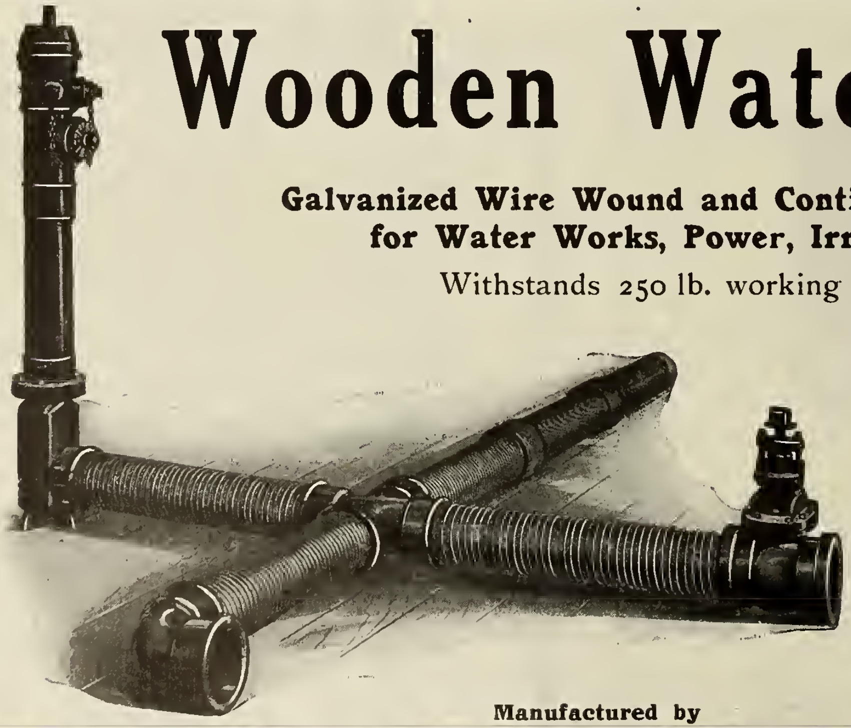

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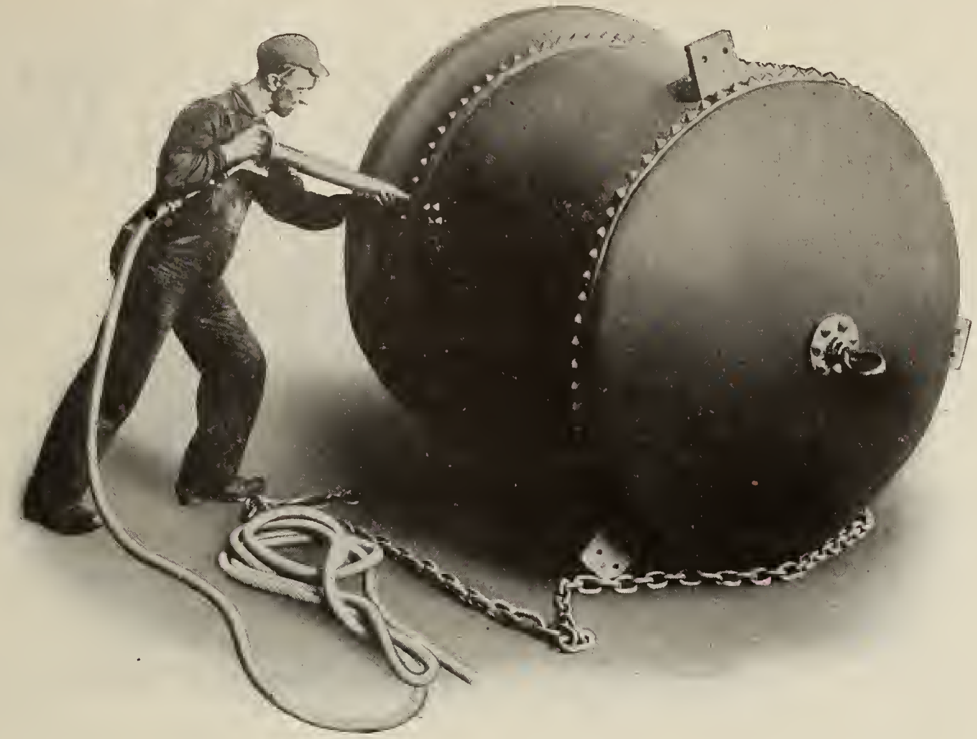

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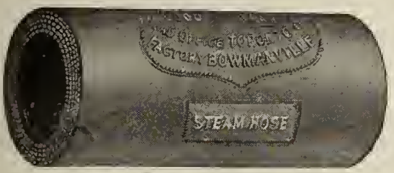

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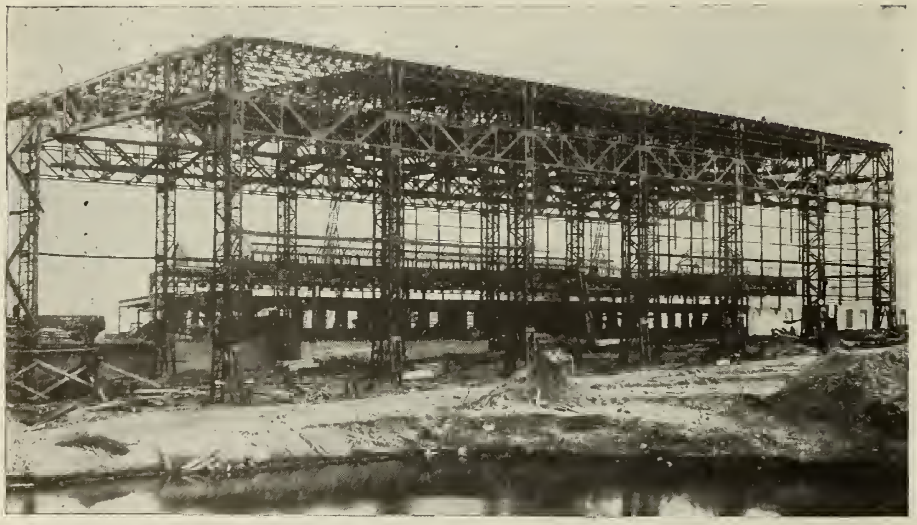

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Economy of Adequate Information to Tenderers

Of the many interesting features in connection with the undertaking of the Vancouver and District Joint Sewerage and Drainage Board described in this issue, none is more noteworthy than the completeness of the form of contract and specification. We have had to voice so many complaints about the inadequateness of the information given to tenderers upon such works as this that we take peculiar pleasure in paying this tribute.

It is fair to assume that the comprehensive details given by the Engineer were largely responsible for the close and satisfactory bidding. Nine tenders in all were received. Of these, eight ranged between $396,000 and $333,000, while the lowest and successful one was $309,000.

The Form of Contract, Specification, Schedule of Quantities and Tender are neatly bound in a permanent form, and, to facilitate reference, the contents are carefully indexed. Every detail and every requirement of the work are described thoroughly with a completeness and lack of ambiguity quite refreshing. The schedule of quantities is prefaced by underlined admonitions to contractors setting forth the points of governing importance. Emphasis is given to the definition of terms and the methods of measurement employed, while a special instruction covers the itemizing and totalling of the tender.

A specification of this kind might be taken as a text for more extended criticism, but it is sufficient, perhaps, herein to draw attention solely to the desirability and ultimate economy of sparing neither time nor trouble in the preparation of information for tenderers. It is of particular value to the authority awarding the contract, as it ensures close bidding and places a premium upon careful figuring.

On the face of it, tenders for the work in question might well have varied considerably more than they did, and the Engineer to the Board, Mr. A. D. Creer, is deserving of commendation for the successful results obtained.

A Municipal Engineering Corps

Those of our civil engineering readers whose hearts respond quickly to the call of country and Empire will be interested in the suggestion regarding the formation of a municipal engineering corps made by our London, Eng., correspondent in his letter published in this issue. Dozens of men identified with various branches of engineering have responded to the call to arms, but hundreds have remained, and there must be some useful work which the great remnant can perform. It is possible that the scheme is of more vital interest to the "tight little island," from geographical and many other standpoints, but the unexpected turn of events of the last month should lead us to an ampler recognition of the fact that to be forewarned is forearmed.

As the natural resources of Canada are developed, the country becomes more tempting, and it is not beyond the realm of reason that covetous eyes and unholy desires have already been turned towards us. At any rate, the more self-reliance shown by Canada in such a time as the present, the greater and more enduring will be her progress when the peaceful ways of commerce are opened up once more. The idea of a military organization of municipal engineers throughout Canada may bring a smile, but the suggestion comes from old London, emanating from a man of wide experience in various parts of the Empire, and, so far as we are concerned, it is entitled to editorial mention by virtue of its originality. In the Old Country, the suggestion is one which the War Office declined several years ago. At that time, however, it was established pretty clearly that the municipal engineering profession throughout the Empire would give energetic support to the movement.

Our municipal engineering readers may engage themselves with the line of opposition they would offer to a hostile force if the occasion demanded some action.

Canadian civil servants may be interested in the salaries obtained in the various departments of the service in United States. At the time of writing, the current issues of our New York and Chicago contemporaries contain advertisements for a Deputy Commissioner of Public Service at Chicago—salary $4,000; for an Illuminating Engineer at Chicago—salary $1,920-$2,400; for a Foreman of Sewer Cleaning at Chicago—salary $1,600-$1,800; and for a Tunnel Foreman at Chicago—salary $7 a day.

We advise cities not to rashly close down work or postpone projects indefinitely, thus throwing many citizens out of employment, but to act on the assumption that in a very few weeks they can raise money on terms at least as favorable as a year ago and possibly as those of this spring. On the other hand, however, every effort should be made to avoid selling at high rates of interest long term bonds which will commit the city to the payment of such interest for many years to come.—Municipal Journal.

The last issue of the Engineering News contains the advertisement of a civil engineer willing to accept any position suited to his experience. He states that he has had twenty years' experience in railway and general engineering and building construction, that he is forty-five years of age, that he is married, that he is in good health, that he speaks Spanish and English, that he has travelled extensively, and that his average salary has been $12,000. It is to be hoped that this versatile practitioner will not turn to the Canadian field as an outlet for his activities. There are 1,378 Canadian applications on file for the first $12,000 vacancy here.

It is the opinion of Dr. Alfred Thompson, M.P. for the Yukon, that the next great railway to be constructed in Canada with be from a point on the Grand Trunk Pacific in British Columbia through the northern part of the province and the Yukon, connecting with the system which is to be built by the United States Government in Alaska. This will open up a vast territory in Northern British Columbia and the Southern Yukon, and provide railway communication from Sydney, C.B., to the boundary line of the Yukon, making it possible to entrain at Vancouver and ride to the shores of the Behring Sea. This railway project is not considered to be by any means a remote possibility. The opinion is expressed that the plans of the United States to spend thirty-five million dollars in building one thousand miles of railway in Alaska will give an impetus to trade in the Yukon.

Business Facts About the War

WITHIN one month the British people have been able to tell the world that they will go about their business as usual, with the war only as an incident.

Do you realize what that means, you business men of Canada? It means the greatest step forward in British enterprise and trades that has ever been taken. While the manhood of Continental Europe is engaged in war the world will not stand still. The men who will be fighting will number no more millions than can be counted on the two hands. Hundreds of millions of people in all parts of the earth will go about their business as usual. There is trade in abundance to be done.

Continental Europe has been pre-eminently the workshop of the world. Great Britain, Canada and the United States must now do the great part of the world's manufacturing. Not for years will any of the Continental European countries recover from the blows they are dealing each other. Meanwhile we of the English-speaking world will have got a long way ahead in the race.

Apart from the dislocation of trade in other countries, think of what the annihilation of Germany's foreign trade means—and already it is annihilated. The exports from the German Zollverein amount to ten millions of marks per annum. Since Germany has committed trade suicide, somebody must do that business. Canada has a better opportunity than any other country to get her share.

There is another consideration. Agriculture will be more or less paralyzed in Europe for years. Yet the nations must eat. Canada, as one of the great food-producing countries of the world, will have enormous demands made upon her for food. This will mean an impetus in the development of Canada's natural resources.

Happy, happy Canada! Though vitally interested in this war, we are far removed from its theatre. Though shocked by war's horrors, and rocked by its backwash, we stand not to lose, but to gain by it. While effete dynasties are warring to their doom, we, in our untrammelled youth, are called upon to take up our full burden of the everyday work of the world. Wealth and work, industry and commerce, are to be transformed wholesale from the old world to the new.

Don't stay aside, you business men, and look on at the war in helpless awe. Don't draw in your business tentacles, and tighten up your purse-strings. This is not the end for you. It is but the beginning. For Continental Europe this war is a calamity. For Canada it is a tide, which, taken at its flood, leads on to fortune.

Engineering Topics in the Old Land

Proposed Municipal Engineering Corps and its Functions—The Discussion Anent the Fresh Air Inlet and the Intercepting Trap

Special London, Eng., Correspondence of the Contract Record

WITH Europe an armed camp, no apology is needed for harking back to a scheme which, although decisively knocked on the head by the War Department, is yet capable of application in the Old Country and might with advantage be adopted in her overseas Dominions. It was in 1909 that the minds of three geniuses (of which the writer was one) evolved the scheme. For some months it was discussed in all its bearings by the trio, and in September a meeting of municipal engineers was called at the Westminster Palace Hotel, London, at which it was decided "that the municipal engineers present constitute a committee to be known as 'The Municipal Engineers Imperial Defence Committee,' having for its principal object the organization, in connection with the defence of the British Empire, of the members of the municipal engineering and kindred professions and their mechanics and skilled labourers." The honorary secretary was at the same time instructed to write to the War Office and the Board of Agriculture bringing certain facts and suggestions to their notice and asking them to receive a deputation from the Committee.

A Municipal Engineering Corps

Shortly, the scheme was the formation of a municipal engineering corps, to act with the Technical Reserve of the Territorial Force, and the salient points of the "facts and suggestions" were as follows: (1) Every local authority possesses on its staff one or more municipal engineers; (2) these have to design and carry out every description of engineering and other constructional work, including the construction and maintenance of practically the whole of the roads and road bridges throughout the country; (3) power stations, hospitals, waterworks, and sanitary works fall within their duties, as do largely the construction and supervision of docks, harbours, foreshores and seacoast protection works; (4) as regards materials and labour they hold a unique position, controlling large bodies of men and knowing the sources available for the supply of material; (5) they have an intimate knowledge of the topography of their districts, and could maintain or destroy lines of communication, or establish other lines, with the least possible delay; (6) the ordnance survey is ever needing revision, and they could form a current ordnance survey department, recording developments and alterations as they arose; (7) in transport matters their aid would be invaluable. It was estimated that the numerical strength of the corps would approximate to 2,000 technical officers and 25,000 mechanics and skilled labourers, many of whom would already have served in the Army or Navy. "By the creation of this force the whole of the British Isles might be sub-divided into convenient areas, each superintended by a responsible engineering official, whose duties, among others, would be to furnish information of a technical character with regard to the district under his control. The corps would constitute 'A Special Intelligence Department,' embracing the entire country, whose records would readily furnish the minutest details of information of even the most remote and secluded district."

Declined With Thanks

To one paragraph in the letter attaches special interest. "Although the suggestions of the committee have relation to the British Isles only," it ran, "it is felt that the engineers and surveyors to municipal authorities throughout the Empire would be prepared to give loyal, generous and energetic support to the movement. Communications with this end in view are being forwarded to the various Colonial Governments. The question of National Defence has never before been recognized, as it is to-day, as a matter of individual duty; and the committee take this opportunity of assuring you that those municipal engineers and surveyors who have been approached are in enthusiastic agreement with the scheme herein sketched out." It would be wearisome to recapitulate all the attempts that were made by the Committee to obtain at least consideration for the scheme. The Press throughout the country were unanimous in their support, and some of the largest papers devoted special leading articles to it. Every effort was futile, however, and the matter had to die the death when the War Department wrote "to express the thanks of the Army Council for the patriotic spirit which had prompted the Municipal Engineers Imperial Defence Committee to submit the scheme for their consideration," but they were "unable at present to sanction the formation of such a corps as was suggested." It is scarcely necessary perhaps to add that the communications referred to were never sent to the Colonial Governments. The committee had had quite enough of Government Departments to go on with. Looking back upon the scheme, and reading it with the most critical care, it remains, in the writer's opinion, one which should have been adopted without question; indeed the word "sanction" scarcely seems to apply. It may not be too late even now, when the present trouble is over, for the matter to be reconsidered.

Since the last paragraph was penned, attention has been called in many directions to the advisability of doing what was suggested in 1909. "Cannot the municipal engineer," writes one gentleman, "make preparations for the proper safeguarding of the water supply, the lighting, the scavenging, and other municipal services in case of need, so that if, unhappily, the occasion arose, he would not find himself unprepared? Cannot he ascertain if the bridges and roads under his charge are capable of withstanding the strain of troops, baggage wagons, and heavy guns making use of them? Should he not carefully consider how he can assist the military authorities in the selection of temporary camping grounds, and the best methods for the supply of water and the removal of the "waste products" of the men? Would he not be the best person to advise as to the choice of buildings which might be the most convenient for temporary hospitals, in case of need? Would not his local knowledge be of the greatest value in settling these and many other points that might arise?" and so on. But singularly enough communications of this nature refrain from any reference to the work of the original Committee. Happily the Committee is quite prepared to sink its individuality, and to say no more about it if only others in the profession will get a move on.

"An Interesting Discussion"

The writer has read with interest the letter from Mr. Frederick Osborne Smith which appeared in the Contract Record of July 29 (page 966). The point at issue between him and Mr. Smith are the fresh air inlet and the intercepting trap. With the abolition of open gullies to receive wastes the writer agrees. "The abolition of the gullies . . . . is a distinct advantage," he said in his "letter" which appeared in the July 1st issue. "The average gully forms a miniature cesspit and Mr. Smith is right when he says ——" and so on. The writer would have no objection at all to a fresh air inlet if it did admit fresh air. His contention is that an inlet may act just as freely as an outlet, and being fixed at or near ground level is a danger to health. Mr. Smith says the fresh air inlet should be "taken outside and fixed as far as possible from any opening into the house, terminating at least 18 inches above ground." The first two points are essential, but as regards the third 18 feet would be better than 18 inches. That every drain should have two untrapped openings for ventilation purposes is agreed, and all the writer asks is that both of these should be at a fair height above ground, and of course removed from window or other openings. Any reader can test for himself the alternation of currents in both inlet and outlet pipes, by simply holding a lighted match in the opening.

Departmental Reports

"It is therefore natural," writes Mr. Smith, "that little or no attention is paid to the report" (that of the Departmental Committee of the Local Government Board), "as lamented by your correspondent." Mr. Smith has misconstrued the "lament." The writer's point was that engineers are beginning to lose faith in expert committees "and especially in the medical expert committee-man." He deplored the fact simply because "guidance of some sort is necessary in these days of swiftly-changing opinion and the unceasing introduction of new appliances and methods." This is not quite the same thing as lamenting that little or no attention has been paid to a certain report. His regret is that one more cherished delusion of youth should have gone by the board. There was a time when Royal Commissions and Departmental Committees were regarded with reverence and their pronouncements treated with respect. They are but seldom treated seriously now, and the fact is certainly to be deplored. As to the intercepting trap as an adjunct to a house drain, the writer has an open mind, and he inclines to the opinion that no hard-and-fast rule can be laid down. In a town having no interceptors at all none are necessary. In a town with a few, those few may constitute a danger; while in a town with many, the lack of one in the few instances may equally well constitute a danger. The subject is too long for treatment here, however; and really the writer's sole point was that text-books insist on the interceptor merely because other text-books do so. That the authors will not think for themselves is clear, as if they did they could not remain in such perfect accord on such a contentious matter. "Intercepting traps are optional in Ottawa," says Mr. Smith in his paper, and it would be interesting to hear the result of any observations that may have been made there as regards trapping and non-trapping.

An Example of Successful City Planning in Germany

An article on the results of city planning in Essen, Germany, where the famous Krupp Steel Works are located, is an interesting feature of a recent issue of Engineering News. Under the impetus of rapid growth the city of Essen adopted a large and comprehensive street plan and the success which has attended the work has placed it in a leading position in this field. The population of Essen is 325,000, an increase of 172 per cent. over the figures for 1900. In 1910, 92 per cent. of the wage-earners of the city were receiving annual incomes of only $216 to $720, and therefore it was found necessary to include in the housing plans a large number of cheap houses. In the new homes it was thought to combine cheapness, attractiveness and healthfulness. That the problem has been successfully solved is shown by the fact that between 1900 and 1910 the death rate decreased from 25.84 to 12.35 per thousand.

An examination of a map of Essen shows a very complete system of radiating streets leading toward the centre of the city, but as these approach the old section they become almost hopelessly lost, as there are no adequately wide streets cutting across the old part of the city. There are, however, a couple of such streets already planned to relieve the existing conditions. This old section might be described as a series of squares and market places connected by narrow, winding and often hilly streets. It has been found necessary to place one track of the trolley line on Kettwigerstrasse on a back street, and the remaining track runs so close to the sidewalk that a pedestrian cannot safely walk too close to the curb.

The streets at first seem to be hopelessly tangled and crooked, but as soon as their arrangement is studied it becomes apparent that this is a carefully planned disorder.

The whole street system is worked out with the primary aim of a characterization of the streets, and there is probably no other city in which this fundamental German idea has been so completely developed. The aim of the planner was to furnish, throughout the city, constantly new and varied vistas, not only in respect to the houses and their relations to the streets, but also in the width and arrangement of the individual streets. The completeness with which this has been carried out is shown by the fact that the range of vision in the streets is, as a rule, limited to 650 to 1,000 ft. The main traffic streets are often exceptions to this rule, but every opportunity has been taken to avoid monotonous stretches on these.

To one used to the average American city plan, Essen streets are at first very confusing and the short and crooked streets perhaps lose some of their attractiveness when they become solidly built up to the sidewalk line with ordinary houses, and the lack of any long views may give a crowding and oppressive effect. A distinct advantage of the irregular system is the readiness with which large open places can be created at the main inter-sections by the cutting off of sharp corners, and advantage has been taken of this is Essen.

Not only do the streets differ from each other, but in many cases the individual streets are unsymmetrically arranged so as to avoid any chance of monotony. That is, the sidewalk is often a wide promenade on one side and an ordinary sidewalk on the other. Several very attractive streets are arranged with a single line of trees which are placed along a wide and principal footway. Another attractive arrangement is made with three rows of trees by placing the main footway between two of them on one side. Even the stereotyped system with two rows of trees is varied by surrounding one by a grass plot and the other with mosaic stone pavement.

It has been attempted to segregate the residences in small groups each of which shall have its own retail stores. An open market place is also usually provided for each residence section. This plan has been greatly aided by the Krupp Company, which has established throughout the city a series of colonies for its employees. The most interesting of these are Magarethenhohe, a colony for the Krupp officials, and Altenhof, in which the old and decrepit employees are provided with charming homes, each designed for a man and wife. These colonies are among the most attractive parts of Essen.

The system of parks in the new part of the city was laid out with a view of having one of the larger parks within five to ten minutes walk from any section, and this has been practically realized. The total park area is not large, as it was in 1910, only 7.4 per cent. of the total area of the city, or about 104 sq. ft. per inhabitant. Essen is, however, much better off in this respect than this figure indicates, due to the large tracts of woodland just south of the city and along the Ruhr River. This district can be reached in fifty minutes by foot or twenty minutes by trolley from the centre of the city and so is readily accessible and is much frequented by the people of Essen. There were in 1910 46.8 sq. ft. of playgrounds for each child in the city.

Essen is primarily a city of low buildings, and the tendency seems to be for the height to decrease rather than increase. This is in part due to the great chance of damage to high or large buildings due to the settlement of the land over the coal mines by which practically the whole city is undermined. Evidences of this settlement can often be seen in the old walls and buildings. The height of buildings in the city is distributed about as follows:

Four storeys in height—10 per cent. of the total area.

Three storeys in height—26 per cent. of the total area.

One or two storeys in height—54 per cent of the total area.

The group system of buildings has been well developed and has helped greatly to furnish variety in the street fronts. Steep tile roofs are usually used, as giving a more attractive appearance and individuality than the monotonous line of flat roofs prevailing in the solidly built up parts of so many cities.

The results have been obtained with the aid of a strict building ordinance, a liberal land policy and a concentration of power under one head. As in most of the German cities the city is divided into several districts according to the use of the land and the regulations for each district are somewhat different. A summary of the restrictions for maximum height and unbuilt areas follows:

	District 1	2	3	4
Max. height of buildings	18 meters	18 meters	16 meters	16 meters
Unbuilt portion of lot	25% (2 & 3 sto.) 30% (4 sto.)	30% (2 sto.) 35% (3 sto.) 40% (4 sto.)	35% (2 sto.) 50% (3 sto.) 55% (4 sto.)	40% (2 sto.) 50% (3 sto.) 60% (4 sto.)

Ordinarily, the height of a building must not exceed the width of the street it fronts upon, although under certain conditions an additional two meters is allowed.

The great detail with which the plans have been worked out can be illustrated by two examples, which are by no means exceptional. In Messelstrasse, one of the houses in a block of three-storey houses was limited to two storeys in height so as to afford from a neighboring street a view of a large and handsome school building. Again, in a plan recently made for an outlying section, arrangements have been made with the evangelical church association to build a large and monumental church at the proposed intersection of five main streets.

The entire plan for the new sections of the city and the modifications of the old plan were designed and are being carried out under the direction of Beigeordneter Dr. R. Schmidt, the chief engineering official of the city of Essen.

Fire insurance requirements with particular reference to fire prevention, as summarized in a pamphlet issued by the New York Chapter of the American Institute of Architects and the New York Board of Fire Underwriters, comprise six important considerations, as follows: (1) Shutters, doors and skylights, outside sprinklers and fire hydrants, to reduce exposure to fire from without; (2) construction of the building to resist for four hours a temperature of 2,000 deg. Fahr.; (3) design of building with limited height and suitable fire stops, lightning protection, wire glass, gravity tanks and proper electric wiring; (4) fire extinguishing equipment; (5) consideration of nature of occupancy, character of contents and class of work, and proper installation of dangerous machines; (6) public fire protection, which depends on the efficiency of municipal fire, water, and building departments.

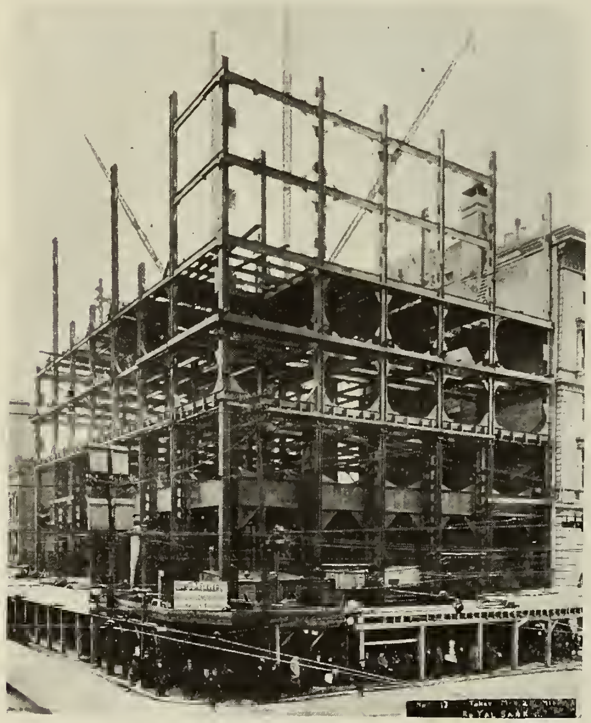
The Hauenstein Tunnel on the Baste-Olten line in Switzerland has been pierced, and, military troubles permitting, will be opened in June next. The tunnel is 5 miles 94 yards in length, and was commenced on February 1, 1912. When completed, it and its approach lines will replace the existing line between Sissach and Olten. On the latter line there is a tunnel 1 mile 968 yards in length, constructed in 1854-8. There is practically no difference between the lengths of the old and the new routes, the reason for the construction of the new line being to secure an easier gradient. On the new route the maximum gradient will be 1 in 95, and in the tunnel the gradient will be 1 in 133 for about 4½ miles, and 1 in 666 for the remaining distance. As a result of the improved gradient, twenty minutes will be taken off the time of the journey between Basle and Olten. The contractors for the new tunnel were the Julius Berger Tiefbau Company, of Berlin, and the price was nearly $4,000,000. The tunnel has been pierced about eighteen months in advance of contract time.

The New Royal Bank Building, Toronto

Progress Report on a Structure which will be the Highest Building of its Class in the British Empire—Interesting Problems in Design and Construction and the Manner of Their Solution

Specially Contributed by J. B. Carswell, B.Sc., A.M. Inst. C.E.

THE new bank and office building now under construction on the northeast corner of King and Yonge Streets, Toronto, has several unique characteristics. Besides occupying a corner site on what is claimed to be the busiest street crossing in Canada, it also has the distinction of being the highest business building yet erected in the British Empire. The height from the sidewalk to the cornice is 255 feet, and above that again is the 20th floor, set back a little from the street line, with the tank-room and machinery pent-house on top of that, giving a total height from the sidewalk of 300 feet. The extreme over-all figure from the bottom of the foundations to the top of the flag-pole is 340 feet.



Royal Bank, May 28, 1914. Showing the heavy wind-bracing details on the King Street elevation.

General Lay-out

The building is placed on a lot measuring 112 feet by 81 feet and is laid out so that a total rentable area of 6,250 square feet is obtained on the typical floors. This constitutes 69 per cent. of the total area of the lot. In the basement the usual boiler room, with a 20-foot ceiling is provided, also the accompanying engine room and storage room for the tenants above. The ground floor is laid out for four small stores facing on Yonge Street. The floors of these will be about three feet below the sidewalk. On the King Street side the ground floor is occupied by the Savings Bank Department of the Royal Bank of Canada. Above these stores, and occupying the whole of the main or first floor, will be the banking room of the Royal Bank, access to which will be had through two doorways on King Street. The main entrance to the building proper is also from King Street. The large elevator hall, with walls and floor of Botticini marble and ornamented Caen stone ceiling, will be a feature of the building. Two stacks of three elevators will serve the nineteen typical office floors above.

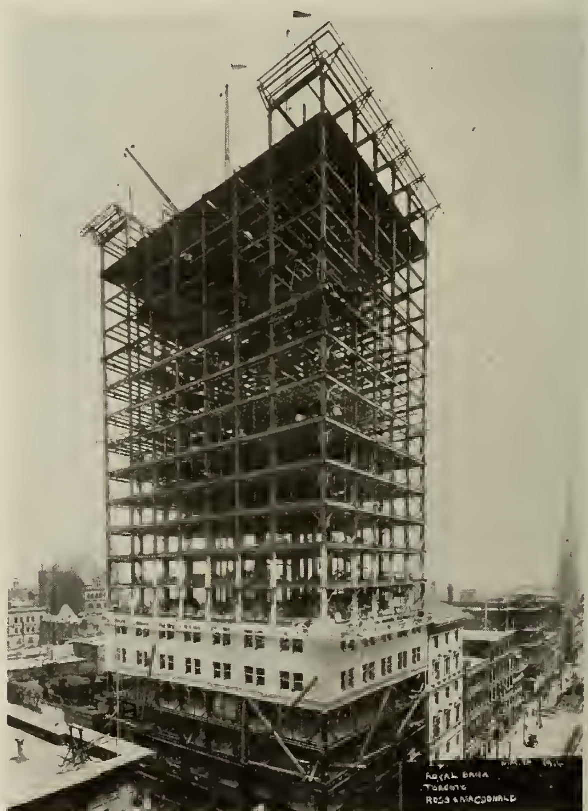
Progress

Fall, 1912

The excavation for the substructure was started in September, 1913, the steel work proper in February ~~of this~~ year, and the exterior stone and terra cotta in April. The steel work, after the heavy girder work for the first floor was placed, proceeded at the rate of three storeys a week. The whole building was closed in during the last week in June and at the time of writing the plaster work is in a fair way to completion. It is anticipated that the first tenants will move in during the latter part of October.

Description

The forty-four steel columns rest on circular concrete caissons, six to seven feet in diameter, bell-mouthed at the base. These caissons are founded on hard shale. At a depth of 35 feet below the side-



Royal Bank, May 16, 1914. Steel work nearing completion. Face terra cotta started at the fifth floor level.

walk, samples of this shale were procured and subjected to crushing tests by the University of Toronto. It was found that the material stood up to 72 tons per square foot. By bell-mouthing the caissons the actual load on the shale under the most severe conditions is about 15 tons per square foot. It is interesting to note that this bed of shale goes down for some 600 feet before real limestone is found. This same stratum may be seen outcropping at the Don Valley brick yards, three miles or so to the northeast of the site.

Many interesting problems presented themselves when these foundations were being designed. On the east boundary the steel columns butted right up against the party line, but the caissons had to be kept within the limits, the result being that the columns rested out on the circumference of the circular caissons instead of in the centre. This was overcome by introducing heavy steel grillage-girders under these columns and under the adjoining row of interior columns. The exterior wall is therefore cantilevered from the adjoining interior columns—which means that the tenant standing in the elevator hall is helping to sustain the brickwork in the exterior wall!

The caissons are composed of 1:2:4 stone concrete. The hard clay met with was simply cut out like cheese to the required dimensions and the concrete poured. Pockets of water under compression with ignitable gas in suspension were found in the shale but were no real obstruction to progress.

The steel for this structure was rolled partly in Germany and partly in Scotland, and it was fabricated partly in the Montreal shops and partly in the Toronto shops of the Dominion Bridge Company. On account of the height, heavy wind-bracing was necessary. This was carried from the basement to the third floor line by auxiliary columns alongside the columns proper. Above the third floor one column carries both the load and the wind stresses. There are 2,600 tons of steel in the building.

Royal Bank, July 4, 1914. A view of the rear elevations from the northeast.

The floors are terra cotta tile arches, with the usual cinder-fill and a cement finish. The two main elevations facing on King and Yonge Streets have a granite base course, large and imposing Corinthian columns of Indiana limestone, with a light cream-colored semi-glazed terra cotta above, forming the main shaft of the building. The rear elevations are of pressed brick, a little darker in shade than the terra cotta. There are 266,000 face brick and 1,164,000 common brick in the job.

The window frames and sash are all of metal, the front elevations having double-hung copper covered windows and the two rear elevations having the regulation fire underwriters' windows.

Royal Bank, July 25, 1914. View of finished exterior.

The woodwork throughout is a high-grade Philippine mahogany, known as "Tanguile". The corridors and public spaces have tiled floors with marble base. The interior arrangements are subject entirely to the requirements of the tenants and hardly two floors will be laid out alike when the work is finished. The building is heated by a direct low-pressure system, operated from two 180 h.p. return tubular boilers. The plumbing, ventilating, and electrical work is all being installed in the most up-to-date manner. The elevator installation will also be the finest procurable, consisting of six Otis-Fensom No. 17, direct-connected, electric machines, operating about 700 feet a minute. Power and light will be supplied to the building by the Hydro-Electric Company. The elevators and all other motors will use 250 volt direct current, and the lighting current will be 115-230 volt, alternating, 25 cycles.

Rather an interesting structural change is being carried out at the present moment on the 19th and 20th floors. After the roof was on the building the Toronto Board of Trade made arrangements with the owners to occupy these two top floors. To give the proper accommodation, five columns had to be removed through two floors. Naturally, this threw additional loads on the adjoining columns and these are being reinforced right down to the 11th floor by encasing them solidly with 1:2:4 concrete having a ¾-in. aggregate. At this level the sections of the columns are sufficient to take the extra load. A large assembly room with a 16-foot ceiling height, unobstructed by columns, is thus provided on the 19th floor. The council room, grain room and general offices will also be on this floor, while on the 20th floor above club quarters will be provided. A feature of these quarters will be the balcony (leading off the dining room and lounge room) from which a magnificent view of the lake, the city and the surrounding country can be obtained.

The finished building, exclusive of the site, will cost about one and one-quarter million dollars. It is owned by the Guardian Realty Company, for whom Messrs. J. and L. M. Wood are the managers.

The Geo. A. Fuller Company are the general contractors. Their sub-contractors for the steel work are the Dominion Bridge Company, for the face terra-cotta the Federal Terra Cotta Company, and for the limestone work the E. F. Giberson Company, while the Don Valley Brick Works are supplying all of the brick, floor tile arches and interior terra cotta. The Ebsary Fireproofing Company are erecting the gypsum partitions. R. C. Dancy has the plastering, Jas. Elgar, Inc., the carpentry, and Robt. McKay the painting. The Architectural Bronze and Iron Works are supplying the architectural iron. Messrs. A. B. Ormsby and McFarlane Douglas (conjointly) have the kalamein, roofing and sheet metal work. The elevators are by the Otis-Fensom Company. The heating is in the hands of Baker, Smith & Company. The plumbing is by Wells & Newton and the electrical work by L. K. Comstock & Company, Inc. The marble work is by the Dominion Marble Company and the tiling by the Wm. H. Jackson Company.

The architects for the building are Messrs. Ross & Macdonald, Montreal and Toronto.

Applied Geology in Municipal Engineering*

By Herbert Lapworth, D.Sc., M. Inst. C.E.

FEW municipal engineers of to-day can fail, after much experience, to realize the importance of practical geology in the construction of their works. The success of underground water supplies, whether attained by knowledge, trial and error, or by a stroke of luck, is admittedly dependent in each case upon the local geology. In works of sewerage, again, the cost may be largely influenced by the nature of the geological materials met with in the trenches and tunnels, producing, as they may do, difficulties and expense in excavation, timbering, dealing with ground water, and modification in the design and construction of the permanent work. The same general principles apply to all deep excavations or foundations that may be carried out by the municipal engineer, whether in the construction of new roads with deep cuttings, sea, river and retaining walls, bridges, reservoirs, sewage tanks, or large buildings. The geology of building stones, road metals, and similar materials, though in a lesser degree, is of importance in all those branches of municipal work in which they are constantly employed.

One of the most striking factors that has forced applied geology upon the attention of the engineer has been the number of disputes which have arisen between contractors and municipal authorities concerned almost solely with the "nature of the ground" encountered during construction of public works. A few of these cases have been taken to the courts, some to arbitration, while others have been privately settled. In most instances the cause of the dispute has been due to some misunderstanding as to the "nature of the ground," or, in other words, the geology of the excavations, and almost invariably the ultimate result has been costly.

Frequently this kind of trouble has been the result of providing intending contractors with inadequate or misleading descriptions of the strata obtained from trial holes or borings. Another cause has been the enforcing under the contract of a type of construction unsuited to the kind of ground unexpectedly encountered in the trenches or foundations.

Quite outside the question of legal disputes, however, serious difficulties have arisen, and heavy expense has been incurred by locating works in bad ground, either through lack of previous geological investigations, or by wrong deductions from haphazard exploration, when such troubles might have been avoided in the original location or largely anticipated by investigation with practical geological knowledge.

It is a remarkable fact that this branch of engineering, common as it is to all classes of the profession, and on which so much frequently depends, is so strangely ignored in our own engineering literature, and until recently so little considered in the scientific training of civil engineers. Thus, we find in our engineering text-books the most minute mathematical investigations of structures, more or less without relation to the varying geological materials on or in which they may be placed.

As a minor example, retaining walls, the dimensions of which, other things being equal, depend entirely upon the geology, water-bearing nature, and dip of the materials to be supported, are subjected to detailed mathematical analysis which may, in the drawing office, be slavishly applied to practice by arithmetical and graphical calculations, without any knowledge of the ground in which the walls are to be built.

To a limited extent the design of tunnel and sewer sections, for example, in "good" and "bad" ground are considered in text-books, but no account is given of the many types of material met with underground under varying conditions, nor of the principles of the occurrence of underground water, the great variation in cost, and the difficulties of construction under different geological conditions. Under "earthwork" we find the usual tables of slopes, prismoidal formulae, and the like, but practically nothing on the highly important subject of "slips," or treatment of soft, unstable or "bad" ground.

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*Paper presented at the recent annual meeting of the Institution of Municipal and County Engineers (Great Britain).

It may be argued, and rightly, that these are matters of actual practice and experience; but this does not excuse the failure of these treatises to impress the student with the great variation in cost and difficulties of engineering construction in different deposits, and the fact that efficiency and economy in construction might be as much the result of geological knowledge and investigation as of skill and experience in calculation and design. In some degree this void in the engineering text-books is due to the extreme complexity and variation in the physical properties of the geological deposits, which render them incapable of mathematical analysis.

Another inconsistency is sometimes to be seen in the letting of large contracts, where we may have items in the schedule of quantities amounting to only a few shillings, yet the contractor may be wholly ignorant of the character of the ground in which the works are to be constructed, and may, in consequence, under-estimate by several thousand pounds the cost of excavation.

The causes which have contributed to the scant consideration of practical geology among engineers are not easy to determine. Probably the chief of these is the fact that, whatever geological difficulties do arise during construction, it is always possible to complete engineering works, whether economically or not, without geological knowledge, and the engineer is not likely to be blamed by his employers for what turns up unexpectedly below ground.

Secondly, there is a pessimism among certain engineers, some of whom, though they may be experienced in excavation work, have little time for geology, and see only a comparatively heterogeneous mass of deposits underground in no sort of order, and to be classified broadly into two types—"rock" and "muck." There is also the optimist, who expects the geologist, by surface indications alone, to prophesy precisely what will be met with in almost every yard of his proposed trench, and, in consequence, loses faith in the accuracy and practical application of the science.

Thirdly, we have scant consideration of the subject in the engineering and geological text-books. The former have already been discussed; the latter, while containing all the necessary elements for the study of the subject, rarely present the applied or practical side of the science, except on the very broadest lines, and include matter that is unnecessary to learn, and which has rarely any direct bearing upon engineering questions.

In the writer's opinion, every engineer should be familiar, first, with the elements of geology—i.e., the principles of stratification, and formation of rocks and deposits, and the various structures occurring in them as the result of formation change, weathering, or earth movements. He should be able to recognize and describe correctly all the common solid rocks and unconsolidated deposits. He ought also to understand a geological map as he does a working drawing, and be able to plot approximately geological sections from it, as well as accurate geological records from borings, trial holes, trenches and tunnels. A training in petrology is desirable for the road engineer, but expert knowledge in this branch of geology usually requires more time than the professional engineer can afford. A thoroughly practical geological training, however, cannot be acquired without considerable experience in the field.

Of equal importance is the subject of hydro-geology. This includes the principles of the occurrence of underground water in different geological deposits, the laws of flow through porous and permeable materials, underground water levels and their fluctuations. The mathematical side of this subject has been considered in great detail by foreign scientists and engineers, but, so far, the quantitative results have been of little direct application to practice, owing to the extreme complexity of underground conditions. Nevertheless, the principles arrived at are of great value in clearing one's ideas, assisting one to anticipate or prophecy, and to deal more rationally with underground-water porblems where a certain amount of local information has already been secured. The value of this science is not only found in questions of water supply, but in the excavation of trenches, cuttings, deep foundations, tunnels, drainage, and the like.

It would be impossible in a paper of this kind to cover the whole of that region in municipal engineering on which practical geology has a direct bearing. The following are merely a few selected instances commonly occurring in practice.

Preliminary Geological Investigations on Important Works

In the majority of important public works it is desirable to ascertain, by means of trial holes or borings, the nature of the ground in which the works are to be constructed. The object of these investigations may be to determine, first, the necessary dimensions of the permanent work and its approximate cost; secondly, the ground-water levels thirdly, whether any saving may be effected by a change in location, if practicable; and, lastly, to enable contractors to make a fair tender for the cost of construction. As regards the latter, it has given rise to discussion among engineers whether data obtained from trial holes and borings should be shown to tendering contractors, because of the possibility of future claims or litigation. Information of this kind, however, allows a contractor to put in a fairer price, and avoids the necessity of his protecting himself, as he often does, by increased prices for unknown ground. Without such knowledge, a contractor's tender must usually be either unfair to the municipal body or the contractor himself; but there are pitfalls, of course, although the more practical geological knowledge there is brought to bear on the investigation, the less will be the risk.

As regards the selection of sites for borings, etc., it is essential that the number of holes should be sufficient to give reliable information, and the strata must be correctly described. Each hole should be sunk to the full contemplated depth of the excavation, and located on the centre line, or within the limits of, and not outside, the work itself.

An interesting example of the result of sinking trial holes clear of the work occurred recently in this country in connection with a tunnel sewer. The trial holes, in order to save expense, were sunk in a railway cutting parallel to the sewer. These proved the ground to consist entirely of sandstone and conglomerate, whereas at least half the length of the tunnel was found to be in marl, the discrepancy being due to the cross dip of the strata. In the sandstone and conglomerate the tunnel was driven without timber, while in the marls close timbering was required throughout owing to falls from the sides and roof. An action was brought by the contractor against the public authority on the basis that misleading information had been supplied to him.

In the solid rocks the selection of the sites for trial holes, etc., can often be much assisted by a knowledge of the surface geology. This is especially applicable to tunnel work and the like; but the majority of municipal works are founded close to the surface, and the nature of the ground is dependent more on the character and depth of the soils, subsoils, and surface deposits of the districts. As the detailed structure and arrangement of the surface deposits cannot be foretold with any accuracy from surface indications, trial holes or borings are essential.

Water Supply

It is, perhaps, in questions of water supply, and especially in schemes from underground sources, that a sound knowledge of geology and hydro-geology is essential. The selection of a site for a well or boring, which will yield a satisfactory amount of pure water, requires intimate acquaintance with the local geology, the order, arrangement and structure and water-bearing characters of its various strata, both as regards its solid rocks and superficial deposits. Familiarity with hydro-geological principles will also assist the investigator in analyzing more rationally from data in local wells and springs, existing underground water resources of the district, and in considering questions of possible pollution from farms, fields, cesspits, cemeteries and polluted streams. Similar principles apply largely to water supplies from springs.

Geological considerations are also highly important in the selection of sites for impounding and service reservoirs, dams and embankments, and in the location and construction of lines of aqueduct, pipes and tunnels; but these are matters, perhaps, more usually in the domain of the consultant, dealing with large schemes, than in the routine work of municipal engineers.

Lines of Sewers and Pipes

In the construction of lines and sewers we find many questions arising where applied geology may be of use in location, design and construction. The most serious difficulties are generally encountered in the unconsolidated deposits of alluvial, glacial, and other recent origin. The beds of clay, silt, mud, running sand and peat, which so frequently occur in these formations, are usually capable of supporting only relatively low pressures, and require great skill and experience in the treatment of cuttings or excavations, being especially liable to slips, and to act as a semi-liquid when their existing stability is disturbed by any excavation within their mass. Occurring, as they do, in the low-lying areas in valley bottoms, estuaries, and mud flats, they are liable to be saturated with ground water, which further reduces their stability, and adds greatly to the difficulties of engineering construction. In addition to the obviously waterlogged ground formed of these deposits in low-lying areas, many lines of pipes and sewers may be constructed in water-bearing rocks, and deposits below the saturation level. The opening out of a deep trench in porous or permeable material below the saturation level has the effect of draining the measures on both sides of the trench, and producing a lowering of the water levels in the vicinity. This may often give rise to claims for damage to local wells and springs. Any trench excavated below river level, in a valley bottom and in permeable strata, will tend to collect a large volume of water, and similarly where the saturation level rises from the valley bottom more or less parallel to the ground surface, a deep trench, although distant from the river, may require heavy pumping during construction. In all permeable surface deposits and permeable strata, such as chalk, sandstone, sands, and heavily fissured rocks, in which trenches are to be excavated, it may be often worth while to determine the underground water-levels in local wells, in order to see whether it is possible to fix the levels of the permanent work above them. Local wells have not infrequently been drained dry during the construction of a deep sewer, and sometimes permanently, so that it has been necessary to deepen them in order to restore their water supplies.

An interesting example of considerations of this sort occurred during the design of the Burton sewerage scheme. Here it was anticipated that a deep-water sewer would affect the yield of the brewers' local wells. Water levels were measured in these wells and borings were made to determine the geological strata. The water levels, when plotted, showed that the proposed deep sewer would be considerably below the saturation level, and that the trench would intercept the water and carry it down the valley. The original scheme was therefore modified, and the sewer raised above the water table through about half the length at the upper or town end.

In considerations of this kind, hydro-geology has shown that the saturation level is subject to seasonal fluctuations; hence it may happen that a trench excavated in dry ground above the saturation level during one part of the year may be flooded during the winter and early spring seasons when the ground water is high.

Heavy pumping and consequent lowering of the saturation level in certain sands, peat bogs, and marshes, may also seriously affect the foundations of adjacent buildings, producing cracks and settlement. Cases are on record where the saturation level has been lowered several feet by pumping, and accompanied at a distance of 200 ft. by a settlement in the buildings of several inches.

In hilly districts, such as parts of Yorkshire and South Wales, for example, sewers and lines of pipes may require to be constructed in steep, sidelong ground and scree slopes. Here there is a strong tendency for the surface material to slip into the trench, and great pressure may be brought to bear upon the timbering, and even upon the permanent work, which may be forced downhill and fracture. Such catastrophies have occurred both on lines of cast-iron pipes and brick culverts in this country.

In certain types of ground, again, such as those formed of steeply dipping shales or clay masses, or surface materials upon a high inclined rock surface, slips are liable to occur, and even the permanent work may require to be strengthened.

Another curious phenomenon is occasionally found in deep trenches wholly in clap deposits, which may appear to be perfectly consolidated and firm during excavation. The weight of the material on both sides of the trench may be sufficient to cause the plastic material to flow, with the result that the timbering must be crushed in and collapse, accompanied by an uplift of the bottom of the trench and of the permanent work. The writer has known of a length of over 100 yds. of culvert invert and side walls destroyed in this way. In some of the glacial clap deposits of Lancashire the trench bottoms have been observed to rise between the operations of trimming the trench bottom and bedding the pipes.

In ground of soft clays, mud, silt, running sand or peat, the difficulties of construction are, of course, at their worst. Special precautions must then be taken from the outset in timbering, strengthening the section of the permanent work, draining, and so dealing with the foundations below formation level as to enable the ground to support the weight of the overlying structure.

Finally, we have those subsiding areas in this country due to coal mining or brine pumping, where lines of water mains and sewers, and especially the latter, are liable to be constant sources of trouble due to unequal settlement of the permanent work. In most instances of this kind the subsiding areas must necessarily be traversed by these lines of works; but it may sometimes be possible to avoid both the affected areas and those liable to future subsidence. Again, problems of surface protection and purchase of the underground minerals may occasionally arise. The subject is too vast, however, to discuss here, but it may be taken for granted that in questions of this kind the engineer armed with a sound knowledge of the local underground geology and its relation to the subsiding surface is likely to be more efficient not only in dealing with lines of pipes and sewers, but with reservoirs, filters, bacteria beds, and other works.

Sites for Sewage Irrigation Farms, Cemeteries, Etc.

In the selection of sites for sewage irrigation areas, the nature of the underlying subsoil is one of the most important factors. Usually extensive stretches of porous or permeable material, such as gravels and sands, prove the most satisfactory land for this purpose. The ground water levels and the direction of underground flow in relation to the nearest stream or river, and the possibility of pollution of local wells and springs should all be investigated. Hence, practical geology and hydro-geology are here both of direct application. Where bacteria beds are in use, and the effluent is comparatively harmless, these conditions, of course, are not so important.

In the location of cemeteries, again, similar investigation is essential. A suitable subsoil, easy to excavate, and capable of standing without support for a short time, is desirable. The maximum height of the ground water should be below the level of the bottom of the graves, and the direction of its flow, where there is any question as to pollution of local wells and springs, should be ascertained, either by actual measurement or by inference from the local geology.

Roads and Road Metals

In the construction of new roads in the colonies or other foreign countries, practical geology may be a very important factor in location, where the choice of a route may be guided by the geology of the district to be traversed. Thus, areas liable to slips, or formed of very soft or very hard material, or requiring heavy retaining walls, may sometimes be avoided by deviation. In this country, however, the routes of the few new roads that are now being, or likely to be, constructed, are more or less fixed within rigid limits. Still, even here practical geology and hydro-geology, when combined with engineering experience, are valuable aids in the excavation and drainage both of the cuttings and the road-bed itself.

As regards the materials for road metals, a sound knowledge of the occurrence and petrology of road stones is decidedly useful. The early experimental and scientific work of Lovegrove, Howe and Flett in this country, and others abroad, was a promising beginning in the scientific study of road metals. The introduction of tar and bituminous compounds, the tests of different materials in actual use on the road, as at Sidcup, and the formation of the Road Board marked further stages. But road engineers are still finding difficulty in arriving at standards of value in road materials, and much practical and scientific work seems still to be necessary, both from the engineering and geological aspects. The modern road must necessarily be a complicated study, containing as it does problems in physics, chemistry, and geology. Perhaps with the establishment, in time, of courses in highway engineering at the universities, so strongly urged recently by Mr. H. P. Boulnois, we may stimulate scientific research in this direction, and, in conjunction with the practical results and experiments of road engineers, evolve a new technology, for which there seems to be a considerable need.

A deep water diving suit was tested in Long Island Sound, off Stamford, Conn., in a depth of 212 ft., which is probably a record for deep sea diving. The suit is in effect a metal casing, looking curiously like a suit of Chinese armor and jointed at the elbow, knee, hip and shoulder, to allow movement of the diver. One arm is provided with a searchlight and the other with a grappling hook. The casing completely envelopes the diver and is of sufficient strength to resist pressures at least as great as that experienced in the test. According to the owner's reports, "no attempt is made to make the suit air-tight, so that all of the water that works in through the joints is kept out by an automatic pump." Air for the diver is supplied through a pipe to the helmet, which pipe also contains a telephone wire.

A framed reinforced concrete engine bed embodying several novel features is now in use at Rockford, Ill. The frame is 11 ft. 6 in. wide at the base and 6 ft. 10 in. at the floor line. Monolithic with the frame are two reinforced concrete engine beds 5 ft. 4 in. long, 24 in. wide and 20 in. high. The rods holding the engine to the bed were not bedded in the concrete; iron pipes were cast in the concrete, leaving openings through the bed proper, through which the bolts were passed after the engine was placed. Heavy washers were placed on the lower end to make a better bearing for the lower nuts. Both ends of the bolts were threaded. A platform 6 in. thick was placed 6 ft. above the basement floor, which served the double purpose of providing a convenient place on which to work while placing the bolts and acting as a stiffener to the columns and preventing torsion due to the action of the double 50 h.p. engine. Although the frame carries a double 50 h.p. engine, scarcely any perceptible vibration has been noted under a full load.

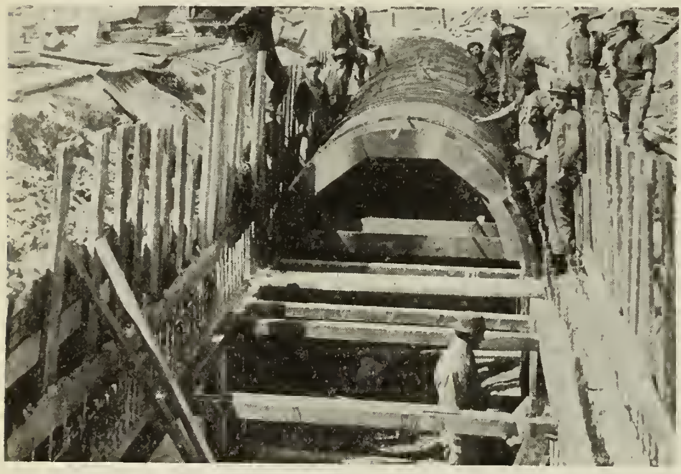
Even where concrete is not specified to go on top of the tile, in hollow tile and joist for floor construction, the contractor should allow enough concrete in the joist to flow over the whole top surface of the tile for a thickness of about one-quarter inch.

The First Unit of Vancouver and Districts' Great Sewerage Scheme

(Staff Article)

OPERATIONS have been proceeding without interruption since last December in connection with the first unit of sewerage construction undertaken by the Vancouver and District Joint Sewerage and Drainage Board as part of the immense joint sewer system embracing the entire area of Burrard Peninsula, which includes 55,600 acres, of which only about 10,000 acres are within the present boundaries of Vancouver, the remainder being in New Westminster, South Vancouver, Point Grey and Burnaby.

It will be recalled that previous to the formation of a permanent Sewerage Board, in 1913, Mr. R. S. Lea, consulting engineer, of Montreal, was retained by a joint committee composed of representatives from each of the municipalities interested—with the exception of New Westminster, to advise them as to a general scheme for the whole peninsula and the best means of constructing and maintaining such a scheme in a state of efficiency. The report, which was submitted early in 1913 and adopted by the committee, advised the formation of a permanent Sewerage Board, this action being carried out forthwith and duly legalized by the provincial government which at the same time granted financial assistance in the form of a government guarantee covering the interest on $10,000,000, the sum for which the board is empowered to issue bonds, and $5,000,000 of the principal.



8 ft. 6 in. horseshoe sewer, China Creek, showing steel reinforcing.

Burrard Peninsula is divided naturally into five drainage areas, which discharge respectively into Burrard Inlet, False Creek, English Bay, Fraser River and Burnaby Lake. Each of these areas was studied as a separate problem in laying out the general scheme, except that the disposal of sewerage from each area was considered in the light of its relation to the other districts or the waters there available for distribution.

The principal discharge into Burrard Inlet will be through an outfall, located at Clarke Drive, which is to drain an area of 8,250 acres with an estimated population of 238,000 in 1950. Parts of the area being made tributary to the Clark Drive sewer will drain into False Creek and Burnaby Lake. The initial work now in progress and steadily approaching completion comprises a portion of the Canoe Creek and China Creek sewers, which the Board decided to construct by day labor. The expenditure to August 1 was $181,000, distributed as follows: labor $114,000, material and stores and plant depreciation $60,000, plant (present value) $7,000.

The work covers the construction of plain concrete sewers and tunnel and reinforced concrete sewers in open trenches. About 70 per cent. of the construction has been completed to date. Nine shifts of an average depth of 25 feet, and 8 x 8 feet across, were sunk at various points in the tunnel during the early stage of operations, and driving was then commenced in opposite directions from each shaft. Altogether, about 3,500 feet of tunnelling has been undertaken in what is known as Contract No. 1. About 1,000 feet of this is through hard pan, most of the remainder being in soft ground, with a small section through running sand. The cost of the miner's piece-work amounted to $5.00 per foot through rock, and $6.00 in soft ground, or $5.50 per foot on an average. The size of timbers used in the tunnel was 8 x 8 feet for the segment sets, with 2-inch logging or poling boards. The proportion of concrete used was one part of cement, two of sand and four of ¾-in. gravel. The method of applying the concrete was first to line the lower half of the tunnel from shaft to shaft and then attend to the roof and upper portions, working from opposite directions towards a given centre, a concrete mixer being placed at each shaft. No reinforcing was used in the tunnel. The sewers in trenches, however, besides being lined with concrete on the same principle as the tunnel, have been heavily reinforced with ½-inch twisted steel except where the ground in the bottom of the trench was sufficiently hard; in such cases no reinforcing was required in the lower half other than for bonding purposes.

An interesting feature of the excavation for the tunnel was the method of hoisting the dirt through the shafts and dumping on the adjoining vacant lots by means of a self-dumping Alaska trolley. This trolley is really the outcome of mining in Alaska, where the cost and supply of labor have always been very material considerations. It is carried on a cable, suspended between the shaft and the dump. A chain attached to the rim of the bucket passes through a loop, which, in turn, slides along a light wire running in a line underneath and parallel to the overhead cable. This loose rope extends down to the bottom of the tunnel shaft where it is securely fastened during the operation of loading the bucket. As the bucket is filled and raised to the surface, the hoisting sheave comes into contact with a hammer attached to the trolley, thus releasing the trolley and enabling it to travel to the dump where a trip, bolted on the loose ground wire at this point, abruptly arrests the progress of the suspended chain, the shock of the contact inverting the bucket.

Practically all of the plant used in connection with this work was purchased second-hand and therefore at comparatively low cost, an expenditure of less than

$8,000 covering the total outlay under this heading. No difficulty has been encountered in obtaining a sufficient supply of labor since the commencement of operations. A force of about 250 men has been constantly employed, the municipal wage rate of $3.00 per day of eight hours being paid.

The cost system employed on the work was designed by Mr. L. E. Wilson, the Resident Engineer, and could be conveniently adapted to all classes of construction work. All plant purchased for the job was charged on a rental basis at a rate per day commensurate with the life of same, and at the completion of the work, the difference between the shipping value plus the total rental charged, as compared with the original purchase price, would be a debit or credit balance as the case might be, and apportioned to the section of the job properly chargeable with it. The stores were charged every month directly into each section of the job, wherever possible, and where items of general stores could not be so charged direct for the reason that they would be used more or less on the whole work, then the cost was distributed pro rata between the various sections of the work in the proportion that each section bore to the whole contract, and further subdivided pro rata between concrete and excavation in their respective ratios. All tools such as picks, shovels, hammers, saws, etc., were treated as general stores as it was considered these would all be worn out on the work, and any value they might possess at the close of operations could be easily adjusted in the final statement of the cost. Progress statements of the cost, together with plans, were turned into the chief engineer every month. A stock account was kept of the materials used in concrete and was shown at the top of the monthly cost statement.

Early in the present summer the Vancouver and District Joint Sewerage and Drainage Board decided to proceed with the second unit of its vast scheme, embodied in the estimates under the heading of "immediate construction"—which covers work to be undertaken during the next five years at a cost of $5,500,000—and tenders for the work, which is known as "Contract No. 2," were called, the following being the list of bids submitted by the various firms competing: J. Gault & Co., $396.396.65; Leddingham & Cooper, $376,769.13; Engineer's estimate (day labor), $365,000; Union Contracting Co., $348,546.24; Engineer's estimate (contract), $348,316.90; Moore & Pethick, $340,100.45; Robt. McLean & Co., $333,646; H. P. Peterson, $332,772.80; Hodgson, King & McPhalen, $309,052.72.

Junction of 6 ft. 6 in. and 5 ft. 6 in. sewers with 8 ft. 6 in. horseshoe sewer, China Creek.

The Board awarded the contract to the lowest tenderers, Hodgson, King & McPhalen Bros., of Vancouver, who have made all arrangements for immediately starting active operations. The contract covers the construction of some 2,700 feet of 6-ft 6-in. x 6-ft. 6-in. horseshoe section, tunnel sewer, and about 5,000 feet of reinforced concrete sewer trench with vitrified brick invert, ranging from 6 ft. 6 in. in diameter to 2 ft. 6 in. in diameter, together with about 15,000 feet of reinforced concrete pipe sewer ranging from 42 inches to 24 inches in diameter. The conditions of this contract call for the payment of the municipal wage rate of $3.00 per eight-hour day for all ordinary labor employed. It is estimated that operations in connection with this branch of the scheme, which takes in the Clark Drive outfall area, will require about twelve months to complete.

Further developments contemplated by the Board which has been provided for in the estimates includes the conservation of the natural drainage channels of the Burnaby Lake district, a work that is considered of paramount importance in its relation to the combined system of trunk sewers. Part of this project comprises the deepening and improving of the Brunette River, which is the overflow from Burnaby Lake. The lake itself is a shallow sheet of water with a mean water area of about 430 acres and a maximum depth in the centre of 9 feet. It lies between Vancouver and New Westminster at a point about nine miles east of Vancouver. Owing to the presence of a natural rock dyke which lies across the outlet to the Brunette River and virtually acts as a dam, the lake overflows its banks and floods the low-lying lands in the vicinity during periods of excessive rainfall. The drainage area, estimated at about 26 square miles, resembles a huge, shallow basin with one side broken—the latter conforming to the end at which the dyke is located. The work to be undertaken will consist of the lowering of the level of this dyke to a depth which will permit of satisfactory draining under any circumstances, and the construction of two interceptors for sewage disposal in the district. The chief engineer in charge of the work for the Vancouver and District Joint Sewerage and Drainage Board is Mr. A. D. Creer,

Driving tunnel in soft ground, Canoe Creek sewer.

Mem. Can. Soc. C. E., A.M.I.C.E., who supervised the preparation of the surveys, estimates and designs contained in the comprehensive report submitted by Mr. R. S. Lea in his capacity as consulting engineer.

Experiments in Sewage Treatment

THE results of recent experiments in sewage treatment were given by Mr. J. D Watson, M. Inst. C. E., at a recent meeting of the Royal Sanitary Institute held at Blackpool, Eng. The protracted hot summer of 1911 emphasized a phase of sewage purification which up to that time we in this country had paid little attention to—namely, the relationship between aerial nuisance and the aerobic decomposition of sewage. It then became apparent that even on small works greater attention to this question was desirable, and in some cases imperative.

As a general principle, objectionable smell should be reduced to a minimum, or, to be more accurate, to the lowest point possible compared to reasonable expenditure. He was not sanguine enough to believe that sewage could ever be purified without producing some objectionable odour, but he saw no reason why such work should not be done without attracting the attention of residents in the vicinity of the works, unless the atmospheric conditions were very unpropitious. It should not be forgotten that much could be done before the sewage ever reached the outfall works, for the production of malodours was greatly facilitated by badly designed and carelessly managed sewerage systems. Not the least important part of the work was efficient house drainage if even the best designed and managed sewage system was to fulfil its functions and transmit foul liquid to the outfall before decomposition set in. When the drainage area was large many hours sometimes elapsed before sewage from the outskirts reached the outfall.

Assuming that the aerobic treatment of sewage was desirable, and he thought there could be no doubt that it was so for at least eight months of the year, all questions as to what objectionable smell was due to, and how it could be avoided, became very important. As he understood the question, the elimination of sulphuretted hydrogen, or the prevention of its formation, would in nine cases out of ten render the sewage practically odourless. With regard to the prevention of its formation, Dr. Soper, of New York, had been of opinion for many years that the introduction of a sufficient volume of air in the sewage would render it almost odourless. Mr. Geo. Fuller said that oxygen seemed to be an antidote for sulphuretted hydrogen.. It was a long time since Waring and other Americans first advocated the introduction of air into sewage as an element of purification, and they must all agree that many benefits would accrue from air blowing into sewage, provided that it could be done at reasonable cost. Whether the air should be introduced before it was distributed over the bacteria beds or introduced at an earlier stage he did not suggest; but it must not be forgotten that temperature, velocity of the wind, electrical disturbances, and so forth, all played a part in the matter.

Air-Blown Sewage

After all, however, the preponderant difficulty was the presence in the sewage of sulphuretted hydrogen and the cost of eliminating it. With a view to getting some definite information on these points he began six months ago to make some experiments, but they had not yet been completed. He might say, generally, however, that they seemed to point to the fact that the object could be attained by a system of air blowing at a cost of not less than 27s per 1,000,000 gallons treated. The experiments included air blowing at various pressures and under varying conditions. The sewage before and after blowing was tested for absorbed oxygen in accordance with the Royal Commission method.

Experiment No. 1 was on a 15-in. pipe, 36 ft. long, fitted with eight rings equally spaced, in which were 1/16-in. holes, through which the air was introduced. Experiment No. 2 was the introduction of air into an 18-in. rising main. Experiment No. 3 was with a 2-in. vertical pipe into which was introduced a single air hole, and No. 4 with a hydro machine.

As a general statement he must say that the results obtained by Nos. 1 and 2 experiments were very erratic and inconclusive. In No. 3 complete saturation was obtained in several cases; but in all cases where complete saturation was obtained there was 30 per cent. saturation in the sewage itself. In No. 4 they had various rates of speed. Saturation varied from 30 to 90 per cent. and they found that the higher the speed the better the results obtained; but it was not easy to obtain a 60 per cent. saturation from speeds of 300 to 400 revolutions per minute. They obtained their best result of 92 per cent. saturation at 540 revolutions. The air was supplied by an air compressor worked electrically.

Taking the cost of electric power at ½d. per unit, which was cheap, the cost of fairly complete saturation worked out at ½d. per 1,000 gallons. He was anxious to find out whether it would be possible to aerate the whole of the Birmingham sewage, after it had arrived at the outfall works, at anything like a reasonable cost. The whole of the experiments were going on, and he felt that in speaking of them at this stage he was acting unwisely. His wish was to induce those who had the opportunity to make similar experiments to do so, for there was a great deal of work to do before any definite recommendation could be made.

The new Thames Tunnel for carrying the mains of the Metropolitan Water Board of London, Eng., between Twickenham and Richmond is nearing completion. The tunnel is shield-driven and is lined with cast-iron segments. It is 618 ft. long between shafts, 60 ft. deep, and has an outside diameter of 16 ft. The tube will accommodate five 36 and 30-in. water mains. The present supply mains are laid in the bed of the river.

Borax kills fly eggs, and about 2 oz. per garbage can will prevent flies from breeding. This is the announcement made recently by the Department of Agriculture. Propagation in stables, garbage piles, rubbish heaps and in fertilizer can now be prevented cheaply without lessening the value of the decaying matter for use by the farmer. Borax, to the amount of 0.62 lb., or calcined colemanite (crude calcium borate), 0.75 lb., was found by experiment to eliminate breeding of flies in 8 bu. of fertilizer. It is believed that this discovery will assist health authorities in campaigns against the typhoid fly. Contractors should welcome the method as an aid to keep construction camps free from flies.

The Selection of Pavements for Roads and Streets

By W. H. Connell†

MUCH has been heard, especially during the past eight years, about the primary considerations that should givern in the selection of materials and methods for building various types of roads and pavements. It is fair to say that highway work would be further advanced and on a basis comparable with other engineering problems if the generally accepted principles derived from scientific research and the practical experience of recognized experts had been more generally adopted and applied.

It must be admitted that highway engineering has not kept abreast of the times as compared with other branches of engineering. As a matter of fact, the problem which presented itself with the advent of the automobile and the consequent revolutionizing of traffic conditions is just beginning to be solved, and while it is true that the highway problem would not be so serious as regards country roads were it not for the automobile, it is equally true that it never received the attention it deserved and was generally looked upon lightly by both engineers and public officials; and the highway departments afforded splendid opportunities to parcel out jobs to men from all walks of life and without any qualifications for the work.

The plane upon which highway departments were formerly placed is probably the reason why men from various walks of life, and doubtless with ability along lines other than highway engineering, freely express their opinions as to how roads and pavements should be built, what is the best type of pavement and, like questions. In many instances the views expressed are not based on knowledge of the subject or on advice from qualified experts. This, of course, goes to show that highway work as an engineering problem is still in its infancy and that public officials and the public have yet to be educated to an appreciation of the fact that this branch of engineering requires special study and that haphazard statements not based on experience or knowledge are just as unwarranted as they would be in connection with any other scientific subject or business enterprise.

Today, unfortunately, while road builders are trying to solve the problem and build adequate roads, enormous sums of money are being wasted and agitations and investigations are being carried on in different highway departments which tend to make it appear to the general public that engineers are not solving the problem. To a certain extent this is true, not because the men who have made a special study of road building have not the ability to build good roads and pavements but because the work is not under their control. This state of affairs, which is usually the result of highway departments being run by officials without experience or training to qualify them for their work, is the side of the subject which is generally before the public; and it is only through meetings of this kind and through publicity from reliable sources that the public will come to appreciate the necessity of placing highway engineering work in the hands of men who are experienced in that kind of work and qualified for it. In other words, highway engineering must be put on the same plane as other businesses and professions, in which success can not be achieved unless the guiding hand is a master builder in that particular line. Therefore, the most important consideration entering into the selection of pavements for road and streets is the selection of men competent and qualified to build roads and pavements and to plan and control the work in an efficient and economical manner. It is no more difficult to find such men than it is to find men qualified to control work in other lines, and this principle is the most important one for engineers and road builders to drive home at every opportunity.

The proceedings of every highway engineering meeting and road convention contain valuable data in connection with this subject. This, however, is of little value unless it is applied in practice, and, unfortunately, there are many officials who make little or no attempt to avail themselves of the opportunities afforded by the proceedings of such meetings as this. In small communities where the work and the money available are not sufficient to warrant the continuous employment of experts, it is always possible to employ an expert in a consulting capacity, as is done in other branches of engineering, and must be done in highway work in order to secure economy and efficiency.

It is a common occurrence for highway officials to receive communications from other officials asking what they consider the best pavement to lay in such and such a town or on their main thoroughfare. These requests do not give any details as to gradient, traffic and other conditions that must be considered. It is obvious from the character of these letters that there is a deplorable lack of appreciation on the part of many public officials of the necessity of employing experts to advise in this work. A great deal of stress has been laid on the necessity of getting proper advice in connection with highway work since it is apparent that if this phase of the question were given more consideration it would furnish a solution of many of the problems of selecting pavements. Qualified experts would treat each case as an individual problem, giving due weight to all considerations entering into the selection of pavements before selecting a pavement best suited to the particular case.

At present, types of pavements and methods of construction are more or less standardized and there are generally accepted fundamental principles which would govern in selecting a pavement for each particular case, and there is little likelihood that there would be much difference of opinion among recognized experts with respect to general principles. It is likely that the difference of opinion in this, as in other branches of engineering, would be confined to minor details.

After securing an organization with the proper personnel, the most important points in the preliminary study for the selection of pavements are (1) drainage, (2) traffic and probable future traffic, (3) foundation, (4) gradient, (5) local, social and sanitary conditions, and (6) wearing surface.

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† Chief of the Bureau of Highways, Philadelphia, Pa.

In order to select the best pavement for each particular road or street, each one of these factors must be given due consideration.

The failure to make proper provision for drainage is probably alone responsible for the deterioration of more roads and pavements than is any other feature of the construction.

Traffic and probable future traffic are most important considerations, and future traffic in particular is often given too little thought in determining upon the foundation and wearing surface.

The foundation is also a most important matter. In determining upon its type or thickness, the primary considerations are climatic conditions, character of sub-soil, and traffic and probable future traffic. In those localities where engineering advice has been lacking, foundation trouble is particularly noticeable. If a pavement is laid to be more or less permanent, it is a penny-wise and pound-foolish policy to skimp the foundation as it will sooner or later result in the deterioration of the pavement. This point is being emphasized today in all of the large cities, particularly in connection with old asphalt pavements, which, in the early days, were largely laid on Belgian block and broken stone foundations. Such pavements were very well for a number of years but are now beginning to deteriorate. They would undoubtedly have lasted longer on more suitable foundations, as the cause of deterioration has invariably been traced to a lack of stability in the foundation. A foundation should be laid which will last during the probable life of the road in its present layout. The economic features must be taken into consideration; and it would be poor economy to put in a permanent structure if it were likely to be ripped up in ten years or so on account of a change in layout. It is wise to put in a permanent foundation on a road which is going to be a permanent fixture, but many of the country and town roads we are now building are more or less temporary.

The gradient is a dominating factor in the selection of the type of wearing surface and the character of the traffic is the primary consideration. If the traffic is entirely of automobiles or entirely of horse-drawn vehicles the problem is easy; but where there is traffic of both kinds, the pavement, especially on grades, must be suited to horse-drawn traffic and the grade kept as low as possible. With reference to the gradient, pavements may be divided into two classes —smooth and rough. In each class there is a number of standard types and each case is a problem in itself, in solving which the percentage and character of horse-drawn and automobile traffic must be considered.

Social, local and sanitary conditions should be given a great deal of weight in selecting pavements for either cities or towns. There are frequently cases where asphalt or wood block is laid on heavy traffic streets in preference to granite block. Such a course might be justified on the score of noiselessness even if the maintenance charges were more than those for a noisier pavement. Noiselessness might also outweigh all other considerations in the selection of a pavement to be placed in front of a hospital or school where, regardless of traffic conditions, any additional expense would be warranted to secure a pavement as nearly noiseless as possible. Another reason for deviating from what would ordinarily seem to be the best engineering judgment in the selection of a pavement might be the necessity for choosing the most sanitary pavement, as, for example, in the slums of large cities where children are constantly in the streets. A third important consideration in the selection of city pavements, and one which has been given very little attention in the past and upon which there is comparatively little data, is the cost of cleaning. It is a question whether under certain traffic conditions it would not be more economical to put down a pavement with a smooth surface that would not stand the traffic as long as the more durable and rougher pavements, on account of the lesser cost of cleaning the smooth pavement. The cost of cleaning a pavement is a direct maintenance charge, but thus far has been given very little consideration in connection with the determination of the cost of maintenance. This is an important consideration, and the time is close at hand when no city pavement will be selected without considering the cost of cleaning per square yard as part of the cost of maintenance. The social and local conditions are also important and are too often neglected. The value of a pavement in keeping with the character of local conditions can not be overestimated.

After choosing the class of pavement suitable to the gradient, the selection of the wearing surface depends upon the traffic and social and local conditions, the amount and character of traffic and probable future traffic being the dominating factors. This requires careful study. Many roads today are deteriorating because this important consideration was neglected and the wearing surface, although ideal under some conditions, is not adapted to the kind of traffic to which it is subjected.

After proper consideration has been given to all of the factors entering into the selection of a pavement and the pavement has been constructed, the most important part of our work begins. We have built the structure; now we must maintain it.

The principal cause of the deterioration of roads and pavements is the lack of appreciation of the importance of maintenance. There are innumerable well-built roads and pavements that are deteriorating because of lack of maintenance. This is particularly true in America, probably because being a new country only lately has engineering talent been considered essential to the construction and upkeep of our highways.

To sum up, the keynote of the solution, not only of the problems relating to the selection of pavements for roads and streets but also to the whole highway situation, is to be guided in our work by the advice of trained and experienced highway experts. If we do this we will not be apt to go wrong in the selection, construction or maintenance of our roads and pavements.

Overhead wires at Richmond, Indiana, are carried on pole lines of which every seventh pole is concrete. A 25-ft. pole, 11 ins. square at the butt and 6 ins. square at the top, costs $7.65, not much more than a good cedar pole when dressed and treated ready for setting. The setting cost is somewhat heavier than for wood, but the advantage of positive anchorage of the line at short intervals more than offsets the added cost. During a recent storm a 35-ft. concrete pole, anchored in two directions, was so severely strained by the fallen line on both sides that one anchor was pulled entirely out of the ground. When the strain was relieved the pole went back into place without apparent harm.

An Unsupported Pavement

Contributed by Herschel H. Macdonald

FOR sixteen months a rural brick pavement seventy square yards in extent, has hung over the void near Tinker's Creek, Cuyahoga County, Ohio. Now the county commissioners are preparing to put a roadway and a base under their pavement.

There is no apparent reason for their step, except the caution which is always counted an official virtue. The pavement had projected like a roomy shelf over the void, eighty feet long and 6½ feet in width, ever since March, 1913. For some time the pavement was used without a guard rail. Later a guard rail was erected to keep vehicles from venturing over the edge of the shelf.

It will be remembered that floods visited Ohio in March, 1913. Dayton was the heaviest sufferer. Northern Ohio, owing to the depth of its river valleys, escaped with little damage. Part of the damage, however, occurred where Tinker's Creek ran parallel to Dunham Road. At this point a retaining wall of heavy stone blocks had been erected and the road built up to a height of some twelve feet above the bed of the creek. Upon the fill a modern brick pavement with a concrete base had been constructed.

The flood completely submerged the road for several days, and when it receded it was found that the wall had been undermined and scattered for a distance of several hundred feet down stream. Nearly half of the roadway had been excavated by the force of the water and the concrete base, deprived of its support, dropped to the bed of the creek.

All that remained was the actual pavement, an unbroken surface of well-grouted brick. The first impulse of the road authorities was to break down the brick shell, to prevent its use, and to rebuild the entire road from the bottom. A man with a sledge was set to work to demolish it. When he had labored for ten minutes and had only broken a single brick, the man in charge decided that such a pavement could not be much of a menace to traffic and so allowed it so stand.

The fame of the phenomenon spread and people came by the score to behold a highway supported by the ether. Innumerable automobiles ventured to the edge of the overhang, until caution dictated a fence along its edge to prevent vehicles from plunging into the creek. A portion of the width of the overhang, however, has always been subjected to traffic since the washout.

The incident has proved a most effective lesson in a cardinal principle of good paving practice, a principle which has made Cuyahoga County roads conspicuous throughout the country. That is, the proper use of a grout filler composed of one part Portland cement and one part of fine sharp sand.

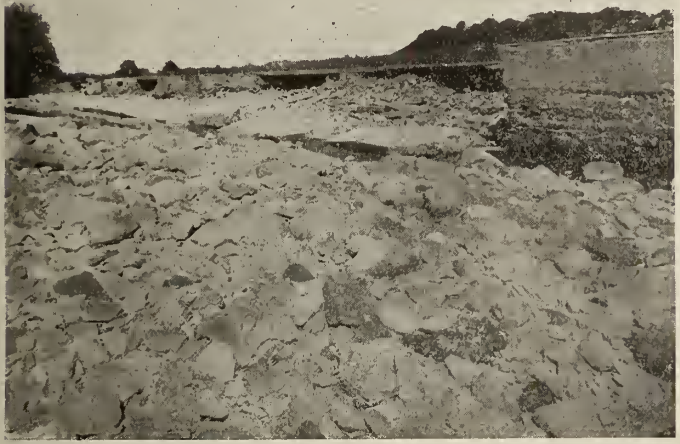
This lesson was not learned in a day, either in Cuyahoga County or elsewhere. Its experimental era was marked by many roads of merit. The early builders were fortunate in being allowed to correct their own mistakes, as well as in the fact that they prepared a type of road that would withstand automobile traffic long before that traffc could have been foreseen.

The Dunham Road pavement presents no unusual features, excepting the strong test to which it was subjected, which impressive as it is, was not made under conditions the identical of which might be found in any properly constructed brick highway.

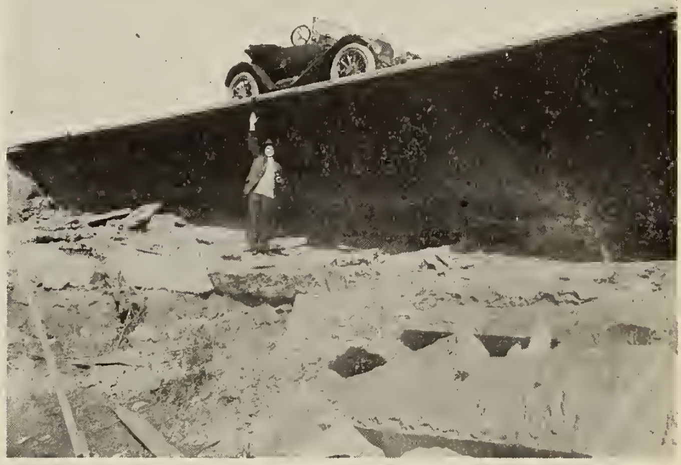
Arch action can have played no part in maintaining the pavement's position. The longitudinal grade of the unsupported portion is an almost perfect level. There is a slight lateral crown comparable to a half-arch, but it is the crown rather than the base of the arch which is supported. The base has no support excepting the lateral bond.

Lest authorities seem to have been remiss in allowing repairs to be so long delayed, it is only fair to say that the principal delay was caused by a project to divert the road, which would have involved the condemnation of land and other lengthy controversy. The delay, however, has been an advantage from the standpoint of the test, as time and the frost action of a severe winter have made the demonstration daily more impressive and opportunity has been afforded for a large number of paving experts to visit the scene and glean such practical lessons as might be had from close inspection.

Cleveland and Cuyahoga County now boast more than one thousand one hundred miles of brick paved city streets and country roads.



The flood washed away the retaining walls and the earth beneath the pavement, undermining the road to a depth of six and one-half feet.



Despite the fact that the ground was undermined as stated, it was able to support the weight of an automobile.

WASHOUT OF BRICK PAVEMENT AT TINKER'S CREEK, NEAR CLEVELAND.

Curtailment of Water Waste and Selection of Meters at Milwaukee Water-Works

DURING the past five years the average daily increases in the water consumption over the preceding year have been as follows:

	Daily increase, gals.
1909	2,304,626
1910	6,407,698
1911	2,259,804
1912	2,779,178
1913	370,424

At the rate of increase prior to 1913 the capacity of the present intake tunnel would be inadequate to meet the demand during the period of maximum consumption long before the new Linwood Ave. intake now under construction, could be completed. This was fully realized by the department about two years ago and all efforts since then have been directed towards eliminating unnecessary waste of water.

Compulsory meterage of all unmetered service, including services supplying the public buildings, parks and grounds; sealing of automatic fire sprinkling systems; sealing of all private fire hydrants, rigid inspection of all premises where water is used for building construction purposes prior to the setting of the meters, and a general inspection of the distribution system, service connections, fire cisterns, etc., was the program mapped out.

Proof that the unmetered services and Automatic Fire Sprinkling Systems caused most of this excessive increase is forcefully shown by the insignificant increase in the pumpage for the year 1913 and the extraordinary increase in the revenue per 1,000,000 gals. pumped since all services are metered and the sealing of the automatic fire sprinkling systems.

The revenue per 1,000,000 gals. pumped for the past years has been as follows:

1911	$45.80
1912	46.76
1913	49.84

As compared with 1912 the increased revenue per 1,000,000 gals. pumped amounts to $53,879.23, in the aggregate. No better argument can be advanced for the maintenance of a water waste department and the efficiency of water meters than the results shown above.

Selection of Meters

There are at present 59,233 water meters in service in Milwaukee. This includes all sizes from ⅝ in. to 12 in. of about 34 different types. When the city first started to meter its taps, which was about 35 years ago, there were few makes of meters on the market. At that time the meters were the property of the water department. Later on objection was found to this and a change was made, so that the meter was required to be furnished by the consumer and maintained at his expense. It is to be regretted that this change was made.

Waterworks, both municipal and private, throughout the country, generally, have found it advisable to own and supply the meters rather than have the consumer supply them as is done in Milwaukee.

It is vital to the success of the meter system that the water department shall determine the meter to be used and the manner of setting, the time for testing and repairs. This can better be accomplished when the meters are owned by the department, as the necessary red tape, delays and expenses involved in sending notices to the owner or occupant and such trips to take off and reset the meters, are avoided. The department also can buy fittings in wholesale at prices lower than those usually charged by the plumbers. Meters purchased in large quantities can be bought at a better discount than is given a plumber, who must necessarily buy them in smaller numbers.

Much time and expense would be saved, yearly, if the meters were the property of the department. As it is now when a meter becomes out of order it is necessary to take it off, insert a connection pipe and average the account during the time the meter is off. This averaging of the account quite frequently meets with objection, as it is impossible to determine if more water was used or less than ordinarily, during the time the meter is off. After the meter is repaired it has to be sent back to the premises where taken off and reset. Two trips are required for each meter that has to be repaired; one to take it off, the other to reset.

Were the meter the property of the water department, when a meter would be found out of order it would be taken off and in its place a meter in perfect condition would immediately be set, in place of the by-pass, as at the present time. These defective meters would then be brought to the shop to be repaired and put in stock and used to replace others, when they become out of order. Fully one-half of the teaming expense could thereby be eliminated.

Competition in the meter business has brought out many makes and styles. The scramble for business has reduced the prices of meters, as well as brought on the market several makes of meters of cheaper construction. Some of these are not perfect in workmanship and trouble is experienced in repairing these meters, as the parts are not standard. Some manufacturers of meters change the style or model of their meters too often. This makes it necessary to add to our stock of repair parts. It has also been found impossible to get repair parts from the manufacturers for some of their models, making it necessary for the department to condemn the consumer's meter and requesting him to buy a new model.

The department, with no specifications as to the style and quality of meters, has, therefore, received meters of practically all makes. Experience has shown that sometimes some makes of meters will pass splendid tests when being tried in the shop, but after they are in service a short time they do not retain their accuracy on a par with other standard makes, requiring considerably more attention and causing innumerable troubles. Under the present arrangement it is a difficult matter for those in charge to bar or condemn meters of such nature.

If the department controlled the purchase of the meters, this condition could not prevail. At the present time it is necessary to carry about $10,000 worth of repair stock on hand at all times, in order to repair the 34 different styles of meters in service. The department, by controlling the buying of meters, would confine itself to a few standard makes, judged by their merit and render it unnecessary to carry such a large amount of stock, as at the present time.

From the large number of meters coming in the shop for repairs it was found that by far the greater number were brought in on account of failure to register, caused by corrosion of the interior of the cast iron outer housing, which in time interfered with the operation of the train gear. The galvanized coating of the casing apparently afforded but little protection as meters brought into the shop after a few months of service frequently showed evidence of corrosion. As the water meter is the property of the consumer and must be maintained by him, meter repair bills are not looked upon with particular favor by the consumer. The department, therefore, decided to prohibit the use of cast iron meters of the sizes of ⅝ to 2 ins. in diameter, feeling that in so doing a large percentage of repairs would be eliminated. With this in view the rules were changed so that hereafter meters of the sizes of ⅝ to 2 ins. inclusive must be of the best bronze composition; meters above the size of 2 ins. to be of the best grade of grey iron. The difference in the first cost between a ⅝-in. bronze and an iron meter does not exceed $1. Bronze meters are cleaner and more sanitary than iron meters, are less apt to get out of repair and will serve to make water meters more popular. Unfortunately this change was not made at a time when there were but few meters in service.

In order to raise the standard of the meters being offered for installation, a resolution was passed by the common council, that meters must be of such a type or types, as shall be approved by the water department. The construction of meters to be as follows:

> The outer casings of all meters of the sizes of ⅝-in. to 2 ins., inclusive, shall be made of a good grade of bronze composition and finished with a bronze coating to give a uniform appearance. Cast iron frost bottoms with interior surface brass lined will be permitted. The outer casings of all meters in excess of 2 ins. shall consist of a good grade of close grained grey iron and shall be painted or coated with a good water-resisting paint or coating. The measuring chambers and gear trains for all meters shall be made of good wearing, non-corrosive hard bronze. Discs and propeller wheels shall be made of the highest grade of vulcanized hard rubber.

Experience has proven that an all brass meter is a great deal more satisfactory than an iron casing meter and the registration of a brass meter is not impaired by rust, as was found in many of the iron casing meters, even though thoroughly galvanized. As most of the outer casings of meters in service are made of iron, it will be the policy of this department to replace the old iron parts with brass instead of iron, whenever found necessary, so that, eventually, the iron casing meter will become obsolete.

The different size services ranging from ⅝ in. to 12 ins. and the various uses of water makes necessary different styles of meters. The disc type of meter, which is the most modern and generally approved meter for ordinary domestic supplies, is made in sizes of ⅝-in. to 4-in. inclusive. It is proving successful on these services up to 2 ins. The 3-in. and 4-in. disc type meter should be discouraged.

In large buildings and manufacturing plants, where a 3-in. or larger service is required, a meter of current or compound type should be installed. The current type meter, which is made in sizes from 3 ins. and larger, is designed, primarily, to handle large volumes of water with a minimum loss of pressure. They are so constructed that the working parts can be inspected or taken out and repaired without removing the entire meter. They, also, retain their accuracy remarkably well and the expense of maintenance is considerably less than that of the old plunger type of which we have quite a number in service. It is the best suited meter, where large volumes of water are constantly used, such as in large manufacturing establishments, standpipes, etc.

In cases where small streams are likely to be used, the best meter would be a compound type. These meters are designed to handle large volumes of water and will also register on small flows accurately. They are made in sizes of 2 ins. and up. A number of these have been recently installed in the city of Milwaukee and have proven very satisfactory. The installation of compound meters should be encouraged in large flat buildings, office buildings, factories, etc., as they insure the maximum revenue, where there is a great fluctuation in the amount of water used.

Oil aids in preventing the warping of wooden forms, as wood that is proof against moisture is less liable to check or warp than wood that is untreated.

It is very important that sand when used as an aggregate for concrete be well graded, for upon the close packing of the grains depends largely the efficiency and economy of the mixture. The coarse grains should predominate. However, the sand should not contain an unreasonable amount of coarse particles.

While counselling caution in every Department, state or otherwise, where expenditure is concerned, we feel very strongly that this is a time when government bodies should make the most generous provision possible for carrying on public works. In hastily curtailing their programmes, a number of provincial governments have distinguished themselves by a lack of foresight and failure to appreciate the most vital responsibility laid upon them—that of helping to maintain the welfare of the people and preserve the internal stability of the country. There are abundant reasons for utilizing funds, or securing money at the best terms possible, for the resumption of capital expenditures upon public buildings in course of construction upon which work has stopped, and for co-operating with municipalities in the provision of good roads.

Photographing engineers' or architects' blueprints is not an easy task without the proper plate and color filter, it being impossible to produce satisfactory results by using the ordinary plate. B. N. Rhoads, photographer, of La Salle, Ill., has found that ordinary orthochromatic plates, with yellow filters, do not give the best results with such a subject, owing to the fact that a great deal of the yellow-green light to which such plates are sensitive is reflected by the blueprint. This trouble has been eliminated and satisfactory results have been obtained by using a deep-red filter with panchromatic plates, thus photographing the print by red light, which completely absorbs the blue. With such a filter and plate the negatives made from blueprints have been found to be as satisfactory as could be obtained from photographing a black-and-white print in the ordinary way. The photography of purple or violet typewriting can be accomplished by using a green filter and plate.

The City-Manager Plan of Municipal Government*

THE city manager is the latest innovation in the government of American municipalities, and strange to say, he is a direct indirect result of the Galveston hurricane. When fourteen years ago wind and wave conspired to wreck the Texas island city, the conditions created by the catastrophe demanded so much progressive and constructive work of the city government that the old system of a board of aldermen and the usual string of independent elective officers broke down. A group ot business men petitioned the state government to suspend the local government and replace it temporarily with a commission of five men. This was done, and the whole city was put under the control of these men, on a strictly business administration. The commission in a few days accomplished what a city council would have required months to do.

Des Moines, the Iowa capital, took up the idea, and improved upon it, and from that beginning the commission form of government has spread with surprising rapidity through the United States, and a peaceful revolution in four hundred cities has swept away the boards of aldermen, mayors and a host of minor officials and has set up new municipal governments on a plan so simple that the services of the "political boss" are not required to direct them.

How and Why the Commission Plan Fails

The commission form of government has placed in the hands of the people an effective instrument of control; a governing organization which is continuously exposed to the full glare of public opinion, which really came from the voters, and which was sincerely anxious to obey them. While this form of government is a vast improvement over the form in general use up to seven or eight years ago, there is unquestionably room for still more improvement. In some of the cities it has proved very successful, while in others it has been a complete failure. This must not be regarded as a defect in the form of the government, but rather as due to the inefficiency of the members composing the commission. Take, for example, Wichita, Kan., where, as everywhere else, the commission plan was hailed five years ago as a "business plan" of city government which would settle all the difficulties under which the town had been laboring. Recently, the commission in this city has authorized the issue of $88,000 in five-year bonds to cover current deficiencies. After four years of the new rule, that does not look like good business. A little searching into the local situation reveals certain things which are directly or indirectly responsible for this condition.

One of the members of the Wichita commission is an ex-street laborer. Street work as a laborer is an honest calling, but does it give a man quite the preparation for managing one of the departments of a city as important as Wichita? There was doubtless excellent reason for electing him, for the labor people had an unquestionable right to select one of their men to represent them in a city's governing body. The man in question had a reputation for integrity and honesty, but even commission government has not made him a good business manager.

Here, then, is one trouble with the commission plan which the Wichita incident brought out in a graphic way: it is only by accident that you can secure five men who will be at the same time representatives of recognized divisions of the people and properly equipped for administrative service.

What, then, is the substantial and permanent contribution of commission government to the city problem? The one great thing it has done is to demonstrate beyond a shadow of a doubt the wisdom of giving over to a single elective governing body all the municipal powers. It has given the people a workable instrument, so far as general regulation is concerned, but it has failed to give the governing body the means with which to translate the general will of the people into detailed acts of government in the most effective way. A five-headed government carries with it the possibilities of friction, leads to inefficiency, which, in turn, leads to waste and even corruption. Furthermore, municipal experts cannot be secured by popular election.

The city-manager plan does away with this five-headedness of municipal administration and substitutes a single head, not with advisory powers merely, but, subject to certain safeguards, with the powers of administrative "life and death," through actual control of appointments and removals.

The chief executive or city manager is not an elective officer, but is appointed by the council. He therefore does not divide responsibility with the council, but is subordinate to it. He need not be, at the time of his appointment, a resident of the city, but may be chosen from anywhere in the country. He is not chosen for a definite term, but holds office so long as he gives satisfaction to his superiors.

The controlled-executive plan filters everything through a group. It reduces the personal equation. Without loss of administrative unity, it abolishes one-man power. A single man may have his ups and downs, his freaks and fancies, his militant points and his passive ones, his natural bents and moods, his pet departments and projects. A board, or commission, or council, or parliament, has none of these things—to a group such excesses are relatively impossible. Even if all the members were cranks, their combined judgment would be reliable—they would neutralize each other.

This plan corresponds to the general manager under the board of directors in a business corporation. It gives the stability of the combined judgment of many men on matters of policy, but leaves execution to a single-headed controlled executive establishment.

For the highest efficiency we must put the chief administrative official, as well as subordinate officials of the same sort, on a professional basis. This means simply that we must leave his selection and his indefinite retention to some person or body that is in a position to examine his work closely and therefore judge of it intelligently, and that we must also take the matter out of politics, not by incessantly harping on the desirability of doing so, but by relieving him of all except purely administrative duties. That is not saying, you will notice, or even implying, that "the people cannot be trusted to choose" the chief administrator. It is implying merely that they are not in a position to do so to advantage, and that if the official in question is given the veto and other policy-determining functions, neither the people nor anybody else can be expected, no matter how well they realize the advantage of experience in administrative work, to do anything but oust him as often as his opinions are not in conformity with those of the majority.

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*By Paul E. Kressly, City Manager and City Engineer of Inglewood, Cal., writing in The Engineering News.

We are confronted with the question: From what profession or calling shall this important position of city manager be filled? My answer is, that the city manager should be a civil engineer, with municipal-engineering experience; who should also possess the additional qualifications of an economist, a financier, and have executive ability.

What other profession has men who are better qualified as municipal experts than the engineering profession? Are not the members of the engineering profession, in the course of their education, field work and research work, peculiarly qualified for executive duty developed by their training and experience? Engineering is perhaps as much a matter of common sense as of education, and the engineer, to succeed, must have both. Therefore, a capacity to get at the facts in any case, supplemented by good judgment, are predominating traits, characterizing this profession more prominently as essentials than is the case with any other profession or calling.

The board of trustees of the city of Inglewood followed the very rational plan of appointing their city engineer, the writer, as city manager, he having served the city in the capacity of city engineer for two years.

My ideals as a basis upon which to erect the superstructure of my organization were efficiency and economy. In order that my administration should be successful, I was compelled to strictly adhere to my ideals and, in consequence thereof, I was obliged to make quite a few changes in the organization of several departments. On account of having been city engineer, I was familiar in a general way with the weaknesses of the various departments, and in order that they be corrected, I determined that the requisites of all employees should be efficiency, economy, honesty and loyalty, and that employees who possessed these qualifications should be retained regardless of their political faith.

With the requisites thus set forth, a few dismissals were necessary, as this city, like many others, was not without political officeholders, who held positions regardless of their qualifications or fitness.

I will not attempt to describe the reasons for the dismissals, but I wish to state that if any of my fellow-engineers ever receive the appointment of a city-managership, and they are obliged to dismiss employees, they need not be discouraged by threats and wild epithets being hurled at them by "political bosses," and their followers, since this is a natural procedure in the course of uncovering the "efficient" and "economical" work of their "pets." There is an erroneous impression grounded in the minds of so many municipal employees that they are not required to do as much work as for a private corporation; that they need not take any particular interest in the work; that working hours need not be observed; that they can take a leave of absence of a few hours every now and then, without consulting the head of the department, and at the same time be entitled to full wages; that they need not be courteous and accommodating to the public; that they can waste materials or supplies because the city pays for them. They labor under the pretext of the old political saying "to the victor belongs the spoils," and are therefore justly entitled to be given employment, and to do whatever they please, irrespective of the quality or quantity of the work performed, or of their value and worth to their employers, or interest taken in the business affairs of the city.

Specific Achievements at Inglewood

The following is a brief summary of some of the important movements undertaken and changes made in the various departments of Inglewood:

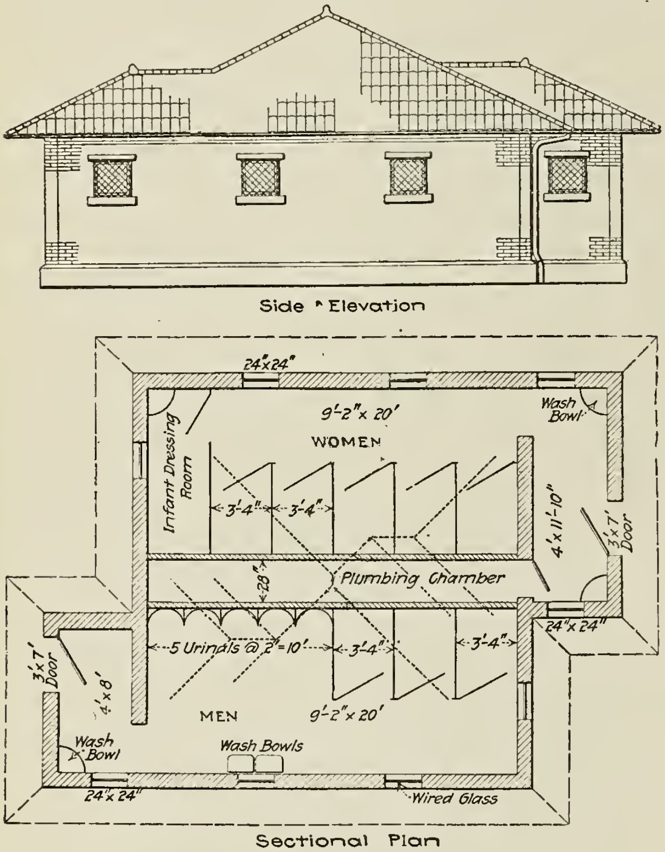
1. The removal of inefficient and incompetent men from the city service.
2. Requiring all employees to obtain an order, signed by the city manager, for the purchase of machinery, tools, supplies, materials, etc.
3. Accounting system installed and providing balance sheets of all accounts.
4. Limiting all city departments to a limited expenditure, and providing for an emergency fund, all within the actual revenues of the city.
5. Monthly detailed reports from each department.
6. Installation of unit-cost system, where practical in all departments.
7. Enlarging and defining the duties and powers of the Park Commission to exercise control and supervision of all parks and street tree planting, and of beautifying the street and avenue parkways by the formation of assessment districts to pay the costs and expenses thereof.
8. Arranged with electric light and telephone companies to have poles removed from streets and avenues into alleys.
9. An Ordinance prohibiting the trimming of street trees by property owners, and delegating these duties to the park commission, and prohibiting the destruction of shade or ornamental trees, shrubs and flowers, and providing penalties therefor.
10. A Resolution providing for the removal of weeds from street parkways, at the expense of the property owners.
11. Commission appointed to revise building ordinance.
12. Commission, composed of five members, one each from Grammar School Trustees, School Teachers, Parent-Teachers Association, Women's Club and City Manager, to arrange for the improvement and beautification of school grounds.
13. Providing more convenient and enlarged quarters for the Public Library.
14. Establishing more stringent rules and regulations governing the care of buildings and apparatus in the Fire Department.
15. Increased the efficiency of the Building, Plumbing and Electrical Inspectors' Department, and placed it on a revenue-producing basis.

There has been much speculation as to the cost of building the Panama Canal, so that it is interesting to learn from figures just published that the expenditure up to March 31 last was rather more than $204,000,000. This was in the Department of Construction and Engineering. The total expense for all purposes was $323,000,000. The smaller figure covers the actual building of the canal, including the cost of the machinery used in its construction.

A Public Comfort Station with a New Feature

THE accompanying plans (reproduced from the Engineering News) show a public-comfort station which will be built in the city of Youngstown, Ohio. The design shows an arrangement similar to that used elsewhere, but with an interesting addition in the shape of an infant's dressing room, which is partitioned off from the women's compartment.

Brick walls, tile roof on wood roof-framing, a brick main dividing wall, and concrete floors, form the shell of the structure. The interior partitions will be of wood, as unfortunately the appropriation happens to be too small to provide slate or other fireproof partitions.



Floor plan and side elevation, public comfort station.

The design secures what is believed to be a structure of excellent appearance at a low cost. The cost is estimated at $2,500, of which the plumbing makes up nearly $1,000.

Paint on Cement or Concrete Surfaces

A paper on "Paint Protection for Portland Cement Surfaces," by H. A. Gardner, Washington, D.C., has for its object the determination of what constitutes a suitable paint for the protection and decoration of exterior and interior stucco walls constructed of Portland cement, and for decorating and rendering wear-proof Portland cement floors.

In April, 1912, Mr. Gardner instituted in Washington a series of tests to determine the durability of various types of paint upon Portland cement surfaces exposed to the weather. The panels for the tests were prepared by constructing a long board wall to which was fastened expanded metal. A mixture of 1 part of Portland cement and 2 parts of clean Potomac River sand was made and applied to the expanded metal, forming a cement wall 3 in. in depth. The wall was divided into 35 sections or panels, each 30 in. wide and 40 in. high. Three coats of paint were applied to each panel by a practical journeyman painter. In order to make the test more severe, nearly all of the paints were applied in white. (Tinted paints are known to be much more durable than white paints.) A strip of chrome green, 6 in. wide, was placed over the top of the third coat of paint, in order to determine whether or not the lime which might be present on the surface of the cement would have any effect upon the paint coating. Fading of the green to a yellow would indicate such action. A priming coat of 25 per cent. zinc sulphate solution was applied to the panels, to neutralize any free lime, but this is held to be unnecessary if the surface is dry when painted and will not be exposed to the weather.

The tests showed that the amount of free lime in fairly dry cement surfaces does not adversely affect high-grade oil paints. The tests also showed that zinc sulphate may be used with excellent results as a primer to neutralize free lime in damp cement surfaces which are to be painted.

Opaque white pigments, such as basic-sulphate white lead, basic-carbonate white lead, zinc oxide, and lithopone, were present in the paints which gave the best results. In some of these paints there was present a percentage of inert pigments, such as barytes, asbestine, whiting, china clay, gypsum and silica. The scaling of varnish paints, which developed in several tests, apparently showed that resinous paints are not well suited for cement surfaces.

The oil paint is not attacked by the dry cement, and holds both texture and color. Equally satisfactory results were obtained with boiled linseed oil, mixtures of raw and boiled oil, and mixtures with Chinese wood oil. Such simple paint coatings were also found to be excellent for concrete floors, being durable, wear-resisting, and dust-preventive.

The results of these tests are quite in line with the results obtained by Ware and Schott in a series of paint exposure tests made upon exterior concrete surfaces. They also agree with previous long-time exposure tests made by the author.

As a result, therefore, it can be stated that excellent results may be obtained by treating cement walls or floors with paints made with raw and heat-treated linseed and Chinese wood oil, containing durable, wear-resisting pigments. When the cement surface is freshly laid and damp, such paints may be safely applied after treating the cement with a zinc sulphate primer.

The general results of the tests at the end of a two-year period, together with an outline of the composition of the paints tested, is given as follows:

Class No. 1—Single-segment paints made with white lead or zinc oxide ground in pure linseed oil. (These paints are in very good condition throughout).

Class No. 2—Combination-pigment paints made of mixtures of white lead, zinc oxide or similar pigments ground in pure linseed oil. (These paints are in generally excellent condition).

Class No. 3—Combination-pigment paints ground with mixtures of raw and heavy-bodied linseed oil or with treated Chinese wood oil. The viscosity of these oils requires the use of considerable turpentine or other thinner in the manufacture of such paints, in order to make them of the right viscosity for application. Semi-flat surfaces are therefore produced during the drying. (Most of these paints are in excellent condition).

Class No. 4—Single and combination-pigments ground in oil varnishes containing acid resins. (These paints are checking and scaling in many spots. Such varnish paints are apparently not suited to exterior exposure).

Class No. 5—Paints containing resins dissolved in volatile spirits (spirit varnishes) with or without pigments. (These paints are not giving very satisfactory service, the clear varnishes having entirely decayed in some cases. Those to which pigment has been added are in somewhat better condition).

Class No. 6—Paints made with single and combination-pigments ground in a water medium containing glue or casein as a binder. (These paints are chalking rapidly and are not moisture-proofing the cement. The pigment binder has been destroyed by the weather).

Typical Specifications for the Wiring of a Residence

We print herewith a typical set of plans and specifications for the wiring of a residence of average size. The dimensions of the house, verandas excluded, are 38 x 26 outside measurement. It is not expected that these plans will coincide with the individual tastes or requirements of every house builder. We believe, however, that they represent a fairly ideal installation taking into consideration the comfort and requirements of the average citizen. In this connection we mention below a number of features which, without adding anything appreciable to the cost of the installation, materially assist in perfecting the refinements of control and make for convenience and economy of operation.

(1) Absence of brackets—It will be seen that there are practically no wall outlets, these being confined to the one in the pantry, one in the attic hall and one in each of a number of closets. Even in these isolated cases a little added expenditure would have been justifiable and have made the installation, in our estimation, still more perfect. The idea is, however, that all brackets shall be controlled by pull chains, these being especially satisfactory for the closet lamp which is intended to be installed immediately above the door way with the chain hanging three or four inches below the frame; this can be picked up easily in the dark by running the hand along the top of the frame. The objection to brackets is daily becoming more universal. They are generally in the way of furniture or decorations; they collect dust and dirt; they engender untidiness as they are often used as hooks, and at best they only localize the light. All the advantages of the wall lamp, without the disadvantages, are found in the baseboard receptacle of which these plans show a liberal number.

(2) Arrangement of circuits—The baseboard receptacles in this plan are kept on separate circuits by themselves. This arrangement gives two circuits in every room so that in the event of an interruption on one circuit the room will not be left entirely without service and a fuse being blown by a fault developing in a worn flexible cord will not interrupt the lighting of any regular ceiling outlet. This gives a somewhat larger number of circuits than is absolutely necessary and takes a few feet more wire, but it has the advantage of allowing a liberal capacity on every circuit so that if an unexpectedly large load is taken from any outlet that circuit is not likely to be dangerously overloaded.

(3) Special closet outlets—As already noted a small wall lamp is provided above the door in each closet. The additional expense for these outlets is very small, the current consumption will be negligible and the added convenience, especially in closets the shape of those shown, is very material indeed. Especially where clothing or supplies is placed on shelves a good lighting is necessary to maintain a proper tidiness. Such a light in the medicine closet will tend to prevent the use of carbolic acid for castor oil.

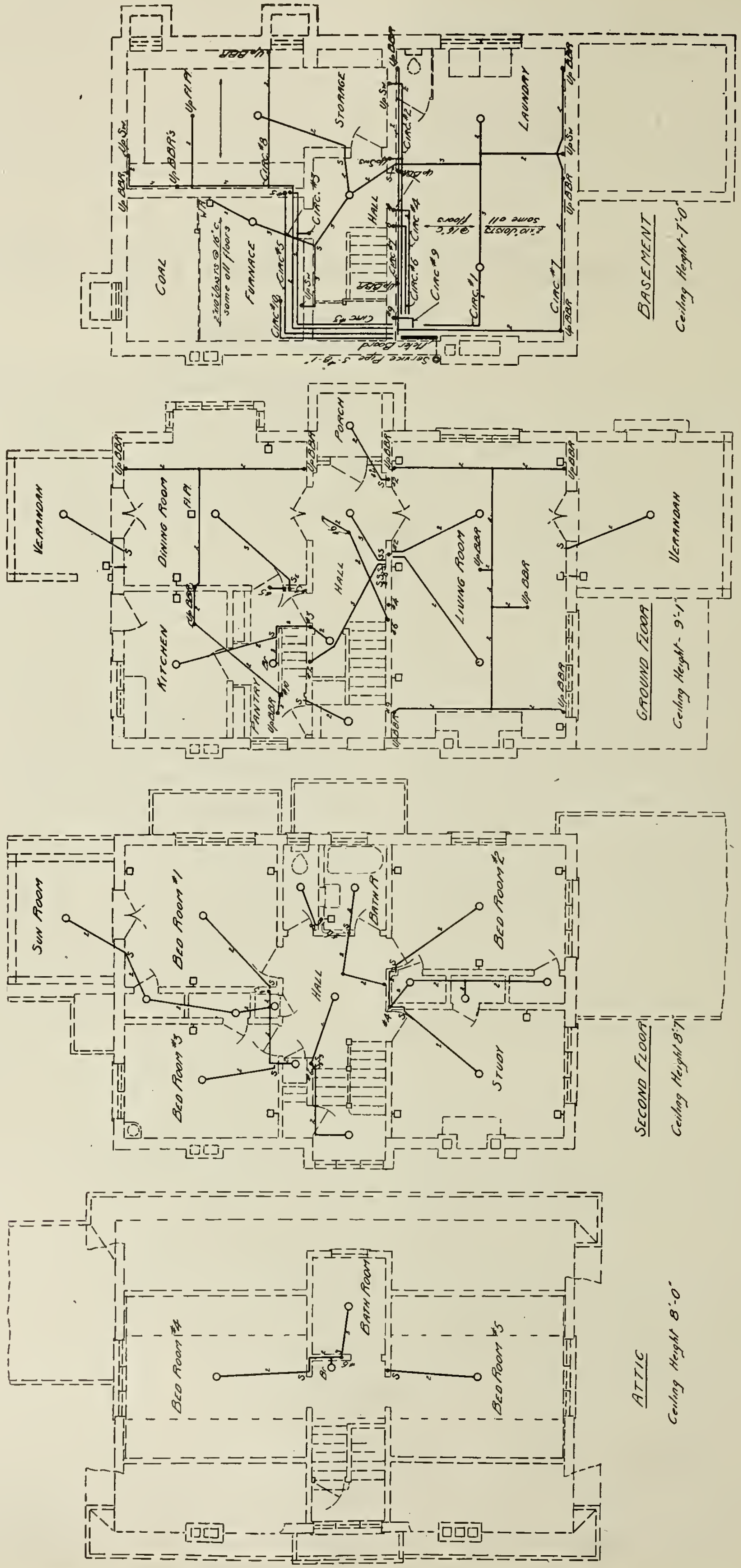
(4) Switch controls—The arrangement of switches in the main halls would appear to be especially convenient without over-elaboration. It will be noted that the lamp in the lower hall is controlled by three switches consisting of the usual two three-ways, one upstairs and one down, and an extra three-way downstairs placed in series with the other two and which acts as a selective switch. This makes possible the use of either a small light or a brilliant light as desired, a small lamp being considered sufficient in most halls the greater part of the time. Three-way switches are not installed to control the attic hall light though this is a convenience many householders would add.

The dining room light is controlled by a two point electrolier switch which admits of low light being used for setting and clearing the table. The rear entrance light is operated from the same switch as the basement hall, it being considered that the former will rarely be needed except when going down cellar and also that it will serve as a pilot to show when the basement light has been left burning. The intermediate landing light is also controlled with the upper hall since this will be a small wattage lamp and is generally needed when the upper hall is needed. Electrolier switches for the living room, though not installed in this plan, would probably be considered essential in the average case as they would make possible better general control of the illumination as, for example, when a number of localized lamps are being lighted from the baseboard receptacles and the full ceiling illumination is not required.

(5) The service is made heavy enough to stand the addition of an electric range. Though in this particular case the wires have not been installed this is only because their installation at a later date will be an exceedingly simple matter.

(6) Ironing outlets—In the back verandah and in the kitchen where ironing is most likely to be done, outlets have been placed high (6 ft. from floor) so that the ironing cord will not interfere with the work. These outlets are equally valuable for any other apparatus. We believe this is an important feature for the hanging cord so often installed in the ceiling is unsightly and does not admit of an absolute uniformity of base receptacle and plug throughout the building—a very important consideration. Individual requirements may demand a similar outlet in the laundry.

(7) Baseboard receptacles—A liberal number of baseboard receptacles are installed at convenient places. These will carry lamps, toasters, water-heaters and, above all, small electric heaters for spring and autumn use before the furnace is operating. A receptacle has been placed on the front verandah as this, if windowed, is most likely to be the place where an afternoon tea or a lazy breakfast will be served. The floor plug in the dining room is also calculated to supply a sufficient number of electric utensils to cook a small meal. The plan suggested is to connect a



Model wiring diagram, for illumination purposes, of a typical residence of average dimensions. (Also see specifications.)

plug in the floor with two or more flush plugs at convenient points in the table. The unsightly appearance of a number of cables hanging from your electrolier is thus avoided. The floor contact also is a permanent one and need only be removed in case the table is to be moved a considerable distance. The two additional baseboard outlets at the sideboard and buffet will admit either of decorative lighting or frying operations which might spoil the table linen.

(8) It will be noted that no provision is made in the hall for the operation of an electric sweeper. It may be contended that the liberal distribution of baseboard outlets in the various rooms would serve this purpose, but we believe it would be better to have a separate power outlet for each hall so that the stairways especially may be reached. This is particularly true of the upper flat where baseboard outlets in the different rooms have not been specified. A hall outlet will, in this case, serve to operate a vacuum cleaner at any point on this flat. It may be contended that in the strictly modern house a stationary vacuum cleaner should be installed, but we believe it is open to question whether a house of the size represented here would be justified in including what may yet be considered as something of a luxury. Much will depend, of course, on the method of furnishing to be adopted. With the modern fairly general unpopularity of carpets and their replacements by small rugs the necessity of the large vacuum cleaner is not so apparent.

(9) No mention is made in the specifications of wiring for bells or annunciators, but this is a matter about which individual tastes differ very widely. In the particular house under discussion we have been given to understand that the front door is connected with one bell and the back door with another; also that the dining room and living room are connected to a (the same) buzzer. In a house of this size upstairs bells hardly seem to be necessary though some householders prefer one push button at least upstairs, which might, in this case, be connected with the front door bell. In the dining room connection is made with a push button in the table through a floor outlet, and a push button in the living room is so located that it is easily accessible from the front veranda. Again it is a matter of individual taste whether these bells should be operated off batteries or a transformer. The strictly modern installation would use the transformer, but where small economies are a consideration it is possible the batteries will be favored.

SPECIFICATIONS

These specifications are intended to cover the supply of all necessary material and labor for the installation of a complete wiring system for lighting, etc., in the new residence for ... ... Toronto.

Working Conditions

1. House is built and roofed but not finished. Electrical work may be started immediately.

2. House is of standard brick construction.

Plans

Plan No. C-38 shows the "Wiring Plan of Residence." and shall be considered as forming an integral part of these specifications.

Circuits are indicated by single heavy lines, the number of wires in each run being marked by small numbers.

In all cases, circuits are located between the ceiling of the floor, on which they are shown, and the floor above.

Detail Specifications

1. Install standard service pipe in rear of house, as shown, same to consist of three No. 8 wires and 1-in. conduit.

2. Install meter board 3 ft. wide by 2 ft. high covered with a clear sheet of ¼-in. asbestos, painted black.

3. On meter board install one 3 p.s.t., 250 volt, 60 amp. knife switch and five 3 to 2 wire double branch fuse blocks with fuses and make all necessary connections ready for meter.

4. Install 10 branch circuits throughout the house as shown on the plan and detailed in the following summary:

Circuit Summary

Circ. No.	Location	Ceiling Outlets	Bracket Outlets	Base Board Outlets	Switches	Watts	Side Service
1.	Basement						
	Laundry	2	..	..	1	..	R
	Verandah .. .	1	..	..	1		
	Hall	1	..	..			
	Rear Entrance.	1	..	..	1	440	
	Storage	1	..	..	1		
	Furnace	1	1 W.R.	..	1		
2.	Ground Floor						
	Living Room.	2	..	..	2		L
	Porch	1	..	..	1		
	Lower Hall. .	1	..	..	2 (3w) 1 (El)	460	
	Upper Hall ..	1					
	Landing	1	..	..	2 (3w)		
3.	Ground Floor						
	Dining Room.	1	..	..	1 (El)		R
	Coat Room ..	..	1	..	..		
	Kitchen	1	..	..	1	400	
	Pantry	..	1	..	..		
4.	Second Floor						
	Study	1	..	..	1		L
	Bedroom No. 2	1	..	..	1	440	
	Closets	..	3	..	..		
5.	Second Floor						
	Bedroom No. 1	1	..	..	1		R
	Bedroom No. 3	1	..	..	1	460	
	Closets	..	4	..	.		
	Sun Room ...	1	..	..	1		
6.	2nd and 3rd Flrs.						L
	Bath Room ..	1	..	1	1		
	Toilet	1	..	..	1		
	Bath Room ..	1	..	..	1	360	
	Upper Hall ..	..	1	..	..		
	Bedroom No. 4	1	..	..	1		
	Bedroom No. 5	1	..	..	1		
7.	Ground Floor						R
	Living Room.	1	..	6	..	420	
	Verandah .. .	..	..	1	..		
8.	Ground Floor						L
	Kitchen	..	..	1	.		
	Dining Room.	..	..	2 (1Fl.Pl.)	..		
	Verandah .. .	1	..	1	1	360	
9.	Second Floor						L
	Study	..	..	3	..		
	Bedroom No. 2	..	..	3	..	360	
10.	Second Floor						R
	Bedroom No. 3	..	..	2	..	300	
	Bedroom No. 1	..	..	3	..		
	Totals	26	11[1]	24[2]	26[3]	4,000[4]	

[1] 2 standard, 8 closet, 1 wall receptacle.

[2] 23 standard, 1 floor plug.

[3] 20 standard, 4 3-way, 2 electrolier.

[4] 2020 R, 1980 L.

Nature of Work

1. All work shall be standard "knob and tube" construction, in all respects of the most up-to-date practice and best workmanship.

2. All wires brought down walls of basement to switches, etc., must be run in metal moulding.

Location of Outlets

1. Ceiling outlets must be accurately located so as to bear a proper relation to decorative detail.

2. Bracket outlets in all closets to be located immediately above the centre of the doorways. (It is intended to equip these with pull receptacles).

3. Other bracket outlets in pantry and top landing to be located 5 ft. 6 in. above floor.

4. Baseboard receptacles to be mounted 6 in. above floor. except kitchen and back verandah, which are 6 ft. above floor.

5. Switch outlet to be mounted 4 ft. above floor unless special wall details require otherwise.

6. In any case where the direction of door swing is reversed from that shown on the plan, the switch must be changed to the opposite side correspondingly.

7. Switch outlets located on any panelled wall must be carefully centered.

Control

1. All switches indicated on the plan will be of a standard single pole type controlling one outlet only, with the following exceptions:

(1) Both laundry outlets to be controlled together by the same switch.

(2) Rear entrance and basement hall to be controlled together by the same switch at pantry door.

(3) Main hall to be controlled by a pair of 3-way switches in lower and upper halls and also with a single button, 3-way switch serving as an electrolier switch.

(4) Upper hall and intermediate landing to be connected in parallel and controlled together by a pair of 3-way switches in lower and upper halls.

(5) Dining room to have a 2-circuit electrolier switch.

Fittings

1. Switches.

(1) Basement switches to be rotary snap switches of approved type.

(2) All other switches to be push button switches of best quality Perkins or equivalent.

(3) Electrolier switch for hall to be a single button 3-way push switch, Perkins Type 0 No. 2458 or equivalent.

(4) Electrolier switch for dining room to be single button, 2 circuit push switch, Perkins Type 0 No. 2460 or equivalent.

2. Switch Plates.

(1) All switch plates to be nickle finish unless otherwise required to agree with room hardware.

(2) Upper hall plate to be standard 2 gang plate.

(3) Lower hall plate to be a single plate providing for 4 two-button switches and one single button switch, Perkins No. 3655 or equivalent.

3. Baseboard Receptacles.

(1) All baseboard receptacles to be uniform and of best quality Diamond H or equivalent.

(2) No plugs to be supplied.

(3) Finish of face plates to agree with other hardware of room.

1. The "General Conditions" attached herewith shall be considered as forming an integral part of these specifications.

2. All materials and workmanship shall conform to the requirements of the Canadian Fire Underwriters' Association and their certificate furnished at the completion of the work.

General Conditions

1. These General Conditions shall be considered as forming an integral part of any specification to which they may be attached and shall be absolutely binding in carrying out any cotnract awarded in accordance with such specifications.

2. The following interpretations shall be taken of terms used throughout the specifications:

The Proprietor means the party or parties who own the building or properties in which the contract is to be fulfilled. In this case ... ...

The Contractor means the party or parties to whom any contract may be let on the basis of these specifications.

The Architect means the architect or firm of architects under whose charge the building work is being carried on and who is exercising supervision over any or all trades which may be doing their work at the same time as the work called for under these specifications. In this case ... ...

The Engineers mean the engineers who have drawn up these specifications and under whose supervision any contract awarded on the basis of such specifications must be carried out, namely Messrs. Ewart & Jacob.

3. The contractor (unless otherwise specified) shall provide all materials, workmanship, plant, scaffolding, carriages, freightage and every other matter that may be required for the proper performance and completion of the work and the whole of which are to be the best of their several kinds.

4. The plans accompanying these specifications shall be considered an integral part of the same. Specifications and accompanying plans are intended to co-operate, so that any work shown on the plans and not mentioned in these specifications, or vice versa, is to be executed the same as if set forth by the plans and mentioned in these specifications.

5. Should any drawings or figures be omitted in the plans and details, which are necessary to a clear, comprehensive understanding, or should any error appear in either plans or specifications, it shall be the duty of the contractor to notify the engineers in writing of such omission or error before submitting tender and in no case proceed in uncertainty with the work.

6. If in the opinion of the contractor a change of plans or specifications should be made for the proper completion of the work and if such change alters in any way the original amount of the tender, the contractor must notify the engineers and submit price in writing for approval before starting the work, otherwise the engineers will not recognize any change in plans or specifications and no claim for extra payment will be allowed.

7. The plans accompanying these specifications are made as accurate as possible, but absolute accuracy of dimensions cannot be guaranteed. No claim for extra payment on account of difference of actual and estimated dimensions shall be allowed, unless such difference arises through alteration of building plans by the architect, or unless such difference shall be greater in amount than ten per centum in each case. On all plans figured dimensions are to be taken in preference to measurement by scale and drawings on a large scale are to be taken in preference to those on a small scale.

8. On all plans, the correct size, location and nature of all walls, partitions or obstructures of any kind are indicated as accurately as possible. If any additional obstacles are encountered the contractor must make good all work through or around such obstacles the same as if they had been originally indicated and no extra claim shall be allowed on account of such obstacles.

9. The contractor shall at his own cost make good any defects, settlements, shrinkages, burn-outs, grounds or other faults in his work, arising from defective or improper materials, which may appear within twelve months after the completion of the contract.

10. The engineers reserve the right to reject any and all materials which, in their opinion, are unsuitable for the proper completion of the work, or not in accordance with these specifications or accompanying plans. Such rejected mater-

ials must be removed from the premises forthwith, and if used after such rejection the contractor shall, at his own cost, tear down such materials and replace same with approved materials.

11. Successful contractor shall be required to sign the specifications and accompanying plans as well as revised contract form in which shall be stated manner of payment, time limit, amount of tender, etc.

12. The proprietor reserves the right to accept or reject any or all bids presented in determining to whom said contract will be awarded. The tenderer's reputation, as well as the amount of his proposal, will be considered and the contract made in accordance therewith.

13. The contractor will notify the engineers in writing when his contract is completed. This dated letter will be necessary to obtain his final certificate, which will be issued within thirty days after notification, if the engineers, on inspecting the work, consider the same complete.

Personal Mention

Mr. Willis Chipman, consulting engineer, Toronto, will report on several electric power schemes for the city of Edmonton.

Mr. D. F. McLeod, formerly City Engineer of New Glasgow, N.S., has been appointed City Manager of Lakefield, Fla. Mr. McLeod graduated from Cornell University in 1907.

Mr. Clarence W. Noble, general sales agent, Toronto, has left his headquarters in the east for a business trip to Portland, Ore., and Western Canadian cities. He will be absent three or four weeks.

Mr. J. B. Carswell, Toronto, a Contributor to This Issue

Mr. J. B. Carswell, the author of an article on the constructional features of the Royal Bank Building, Toronto, published in this issue, hails from Paisley, Scotland. He graduated from Glasgow University with the degree of B.Sc. and served his apprenticeship as a civil engineer with Mr. J. B. Brodie, a well-known practitioner in Glasgow. Coming to Canada, he was employed for some time on the engineering staff of the G. T. R. His experience in constructional work has been wide and practical, embracing both the architectural and the contracting side. At present he is the Toronto representative for Messrs. Ross & Macdonald, the Montreal architects. With the Royal Bank and the Central Technical School, both Toronto projects, under his supervision he has charge of two of the most important building undertakings in Canada at the present time. Mr. Carswell is an Associate Member of the Institution of Civil Engineers.

Mr. J. B. Carswell.

Another Contributor—Mr. A. D. Greer, Vancouver

Mr. A. D. Creer, Mem. Can. Soc. C. E., A. M. I. C. E., is Chief Engineer of the Vancouver and District Joint Sewerage and Drainage Board, an account of whose initial constructional operations appears in this issue. Educated at Yorkshire College, Leeds (Eng.), he served articles with his father, Mr. A. Creer, who, at that time, was City Engineer of York. Later, he took a position on the staff of the late Mr. James Mansergh, F. R. S., with whom he was associated for a period of fourteen years. Mr. Mansergh, it will be recalled, successfully carried out such immense schemes as the Birmingham (Eng.), waterworks (a 35-million-dollar undertaking), the Colombo (Ceylon) and Melbourne (Australia) sewerage systems and many other large waterworks and sewerage projects in different parts of the world. Coming to Canada in 1912, Mr. Creer became identified with Mr. R. S. Lea, consulting engineer, of Montreal, and was personally responsible for the surveys, estimates and designs embodied in the report of Mr. Lea dealing with the comprehensive joint sewer system for Greater Vancouver. When the Vancouver and District Joint Sewerage and Drainage Board came into existence, in August, 1913, Mr. Creer's valuable services in his capacity as assistant to Mr. Lea were given the highest commendation and he was appointed Engineer-in-charge of all works undertaken by the Board.

Mr. A. D. Creer.

Mr. C. J. Gibson has been appointed Town Engineer of Bowmanville, Ont.

Mr. R. C. Harris has been appointed Resident Engineer of the Alberta Division of the Canadian Pacific Railway at Calgary.

Mr. D. H. Martin is Chief Engineer for Messrs. Jas. Corbett & Sons, Limited, sub-contractors on Section 5 of the Welland Canal.

Mr. J. H. Clark, a member of the staff of Mr. R. E. Speakman, City Engineer, has been appointed Purchasing Agent for Brandon.

Mr. R. L. Dobbin has been appointed water-works superintendent for the Peterborough Utilities Commission, Peterborough, Ont. Mr. Dobbin was formerly resident engineer on the Moose Jaw water supply for two years during construction. He was also with the city of Moose Jaw in the water-works department.

Mr. R. L. Haycock, has succeeded—temporarily at least—Mr. A. N. Beer in charge of the Water-Works and Sewerage Department at Ottawa.

Mr. W. R. Sinclair, a well-known railroad and general contractor, of Winnipeg, died recently, aged 67. The deceased gentleman was a native of Scotland.

Mr. J. T. Brown has been appointed Resident Engineer and Superintendent of Bridges and Buildings for the Canadian Pacific Railway at Cranbrook, B.C.

Mr. J. D. Evans, Chief Engineer of the Central Ontario Railway, has been appointed Division Engineer of the Ottawa Division of the Canadian Northern Railway.

Mr. D. H. Martin, division engineer of the Pittsburgh & Shawmut Railroad, has been made chief engineer of the new Welland ship canal, with office at Allanburg, Ont.

Mr. R. W. Brock's New Appointment

Mr. R. W. Brock, who for some years has been a contributor to the Contract Record and Engineering Review, has resigned his position as Director of the Geological Survey and Deputy Minister of Mines, at Ottawa, to accept an appointment as head of the Applied Science Department of the University of British Columbia, which is now being established. A native of Perth, Ont., Mr. Brock obtained his undergraduate training at the University of Toronto and Queen's University, and took a post-graduate course at Heidelberg, Germany. He commenced geological survey work in Northern Ontario in 1891 and later had charge of important investigations in the British Columbia field. Such was his application that he came to be regarded as one of the leading Canadian authorities on economic geology. In 1902 he was appointed Professor of Geology in the School of Mines at Kingston, and he retained charge of the Department of Geology of this school and at Queen's University until his appointment as Director of the Survey in 1907.

Mr. R. W. Brock.

Mr. R. A. Baldwin has been appointed Engineer of Maintenance of Way of the Ontario Grand division of the Canadian Northern Railway, Eastern lines, with headquarters at Toronto, Ont.

It is interesting to recall the fact that both General Joffre, Commander-in-Chief of the French Army, and Lord Kitchener, the new head of the English War Office, are engineers by education and experience, as well as soldiers. General Joffre is a graduate of the Ecole Polytechnique, Paris, and obtained much of his early experience in the engineering corps, having had charge of railway construction in West Africa and harbor work in Madagascar. Lord Kitchener is a graduate of the Royal Military Academy, at Woolwich, and entered the Royal Engineers in 1871. Between 1874 and 1882 he had charge of extensive survey work in Palestine and the Island of Cyprus.

Mr. Arnold Pfau, one of the foremost designers of hydraulic turbines, has been detained in Switzerland, where he is eligible for army service. Mr. Pfau is consulting engineer to the Allis-Chalmers Company, Milwaukee, Wis.

Mr. Thomas Turnbull has been appointed assistant Chief Engineer of the Canadian Northern Railway, with headquarters in Winnipeg. For the last four years Mr. Turnbull has been with the Canadian Pacific Railway in the West, and with the Hudson Bay Railway.

Mr. T. Aird Murray, Consulting Engineer to the Province of Saskatchewan, accompanied by Dr. Seymour, Commissioner of Public Health, has been making a tour of inspection of the sewage disposal works throughout the province. He has inspected the plants at Indian Head, Estevan, Weyburn, Yorkton and other places.

Obituary

Mr. John Middleton, who was a member of a Canadian Northern Survey party, fell a distance of 70 feet from a ledge of rock near Lytton, B.C., and was killed.

Mr. Murdock Lloyd, a mining engineer who belonged to Toronto, died from injuries received in a boiler explosion at the Tough Oaks Mines, Swastika, Ont., recently.

H. W. Anthes, Managing Director of the Anthes Foundry, Limited, Toronto and Winnipeg, died recently. The late Mr. Anthes was born in Wilmot Township, Waterloo County, Ont., in 1851. Both his parents were natives of the Province of Alsace, Lorraine, which is figuring so prominently in the present war. In 1889 he established the Toronto Foundry Company, Limited, the name being changed subsequently to the Anthes Foundry, Limited.

In July last a fresh break occurred in the Montreal water conduit, which necessitated prompt measures being taken to repair the damage by means of a band of concrete built around the part affected. Mr. Henry R. Lordly reported upon the effects of blasting upon the conduit, and following this Mr. Rudolph Hering, of Hering & Fuller, the New York consulting engineers, has submitted a report to the Board of Control to the effect that, in view of Mr. Lordly's experiments, there is no danger of proceeding with the rock excavation within certain limitations. In Mr. Hering's opinion there is no necessity for constructing a new conduit, as, with certain exceptions, the conduit is in very good condition. The break which occurred last July was not caused by normal conditions either within or adjoining the conduit, and in Mr. Hering's view it could be due only to an explosion which took place inside of the conduit where the break occurred.

The 16th Annual Convention of the Ontario Municipal Association is now being held at the City Hall, Toronto, the dates of the meeting being September 2-3. The programme is an attractive one and includes papers upon many phases of municipal administration. Mr. W. A. McLean, Chief Engineer of Highways for the Province, is scheduled to deliver a paper, "The Cost of Roads." The subject of the paper to be given by Mr. S. H. Kent, City Clerk of Hamilton, is "A Government Minister and a Department of Municipal Affairs." The President of the Association is Mr. J. G. Richter, of London, Ont.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The Board of Trade at Fort William have recommended to the city a site for the C. N. R.'s proposed station buildings.

Lime & Agencies is the name of a new Toronto concern, capitalized at $40,000, which will engage in the manufacture of brick, terra cotta, and sewer pipe.

Tenders are now being called (close September 3) for a new town hall at Lachine, Que. The architect is Mr. D. Viau, of Montreal. The cost is estimated at $100,000.

Twenty-three miles of new pavements have been laid in the City of Montreal this season to date. This brings the total of paved streets up to 132 miles—out of a total mileage of 480.

It is expected that the plant of the Canada Wire Nail Company in West St. John, N.B., will be in operation in a week or so. All the machines have been set up and the plant is prepared for a big output.

There is no truth in the rumor that the Dominion Steel Company has closed down its plant at Sydney, N.S. From the General Manager, Mr. J. H. Plummer, comes word that despite a reduction in the staff there are still 1,600 men at work.

From Grand Falls, N.B., comes a report that the new bridge across the river below the Falls has been completed and formally opened for traffic. This structure takes the place of an old suspension bridge which has been in use for upwards of fifty years.

The Anglo-Canadian Construction Company, Limited, North Bay, Ont., has been incorporated with a capital of $100,000. The new firm will carry on a general contracting business. Mr. H. R. Miles, civil engineer, North Bay, is interested in the enterprise.

A $20,000 addition to the factory of the Remington Arms Company, at Windsor, is being made by Messrs. Wells & Gray, of Toronto, architects and general contractors. The addition is to be one-storey high, of steel, reinforced concrete and brick construction.

The Dominion Government is considering the matter of building an addition to its elevator, situated between Fort William and Port Arthur. The present storage capacity of the elevator is 3,250,000 bushels. The proposed addition will probably double this capacity.

At Ottawa, Ont., operations on the stores and apartments which are being erected on Rideau street for Donald Fraser have reached the third storey. The building is of solid brick construction and will cost $180,000. The architects are Messrs. Horwood, Taylor & Horwood.

The Montreal firm of Messrs. Barott, Blackader & Webster, are now associated with Mr. P. A. Westover, of Philadelphia, in the architectural work for the new theatre which is to be erected at the corner of St. Denis and St. Catherine Street, Montreal, by the Imperial Theatre Company.

The foundation work has been completed for the office building which the National Trust Company proposes to erect in Montreal at a cost of $150,000. The architect is Mr. Kenneth G. Rea and the general contractors are Messrs. Norcross Brothers, New Birks Building, Montreal.

Mr. R. C. Harris, the Toronto Works Commissioner, has submitted to the Board of Control a recommendation that gold watches suitably inscribed be presented to the members of the Works Department who were identified with the sewer gas tragedy in which a member of the staff, Mr. Robert G. Strathern, lost his life.

In connection with the New Toronto water-works scheme, it is of interest to note that operations have been commenced by Mr. J. E. Curley, who is the contractor for the 18-in. intake pipe and mains. The pumping station and other work will be commenced shortly and it is expected that the whole scheme will be completed by the end of the fall.

The city authorities at Montreal claim overcharges on the Notre Dame de Grace sewer work, and action to recover the amount from the contractors will be taken. It is claimed that clay and loose boulders were charged for at the rate of solid rock. The contractors will contest the action and promise to raise some interesting points as to classification.

The University of New Brunswick is now holding its annual engineering camp at Sussex, N.B. Professor John A. Stiles, Dean of Engineering, is in charge, with Mr. G. T. Feeney as Assistant. The period of encampment is from August 24 to September 12. The students engage in practical work in railway construction, stream measurement, surveys, and so on.

St. John, N.B., has taken advantage of the New Brunswick City Planning Act, and a Commission has been appointed. It may be some little time before the provisions of the Act are made effective, but when the new Commission gets down to work it will see that there is the minimum delay in applying the Act to local conditions. The desirability of having regulations of this character is fully recognized by the City Council.

In the field of projected work, interest centres around the construction of the Don Section of the Bloor Street Viaduct tenders for which close October 5. Tenders have been asked for a bridge consisting of five steel arch spans with piers and approaches, the width being 86 ft. and the length approximately 1,618 ft. Specifications and plans are open for inspection at Toronto, London, Eng., Chicago, and New York. Contractors tendering on reinforced concrete construction are submitting plans and specifications at their own expense.

From Hamilton comes the report that everything is in readiness for an immediate start upon the erection of the Royal Connaught Hotel. At a Directors' meeting recently, Sir John Gibson, President, stated that the building would cost perhaps $100,000 more than the early estimate of $1,000,000. The structure will be twelve storeys high. The steel contracts have been let and satisfactory bulk tenders are stated to have been secured. Mr. H. L. Frost, Vice-President of the company which is promoting the hotel, emphasizes the fact that the business interests of Hamilton cannot afford to have the construction of the hotel postponed. He considers that it is most desirable for the work to proceed without delay. "Hamilton," he says "has goods to sell which will be required all over the world, and with a number of European countries out of the export business, it will not be long before there is an active demand for nearly all lines. The $1,000,000 Connaught Hotel is a prime necessity at Hamilton."

WESTERN CANADA

The latest addition to the modern office buildings in the City of Vancouver is the fifteen-storey Standard Bank Building, which has a frontage of 78 ft. on Hastings street and 120 ft. on Richards street.

A branch of the Canadian Society of Civil Engineers has been established in Edmonton, with headquarters at the University of Alberta. Professor W. Muir Edwards has been elected Chairman, and Mr. L. B. Elliott, Secretary-Treasurer.

At Winnipeg, two apartment blocks are under construction at Fort Rouge. The owner and general contractor is Mr. P. MacKissock, and the architect is Mr. W. B. MacKissock, Winnipeg. The building will be of brick construction and will cost $120,000.

Operations are about to commence on the new post office at Saskatoon, which is to be erected at a cost of $100,000. The construction will be of brick and stone. The work will be under the direction of the Department of Public Works, whose District Engineer for Saskatchewan is Mr. L. R. Voligny.

At Winnipeg, operations are in progress on the Grain Exchange, which the Traders' Building Association is erecting at a cost of $500,000. The building will be of stone, brick and steel construction. The architects are Messrs. Jordan & Over, and the general contractors are Messrs. Carter-Halls & Aldinger.

From Saskatoon comes word that operations are being rushed on the construction of the Dominion Interior elevator. The war has had the effect of hastening work on the completion of the interior storage elevators in Western Canada, as it is hoped that these structures may play an important part in the machinery for the feeding of the allied armies.

According to a despatch from Lethbridge, a discovery of twenty-three kegs of blasting powder was made recently in the vicinity of the C. P. R. viaduct, over the Belly River. Shortly afterwards the Mounted Police arrested a man named Hermann Weirmeir, on his way towards the shack in which the powder was stored. A heavy guard at the bridge is now maintained.

The Eighth Annual Convention of the Western Canadian Irrigation Association was held at Penticton, B.C., from August 17th to August 19th. The meeting was attended by irrigation authorities from California, Oregon, Idaho, Washington and Utah, as well as from the Prairie Provinces and British Columbia. The Secretary of this association is Mr. Norman S. Rankin, Edmonton.

Calgary is congratulating herself on the announcement that there will be no halt in projected public work. The new government elevator, upon which some three hundred men will be employed, will be rushed to completion. This contract will involve eighteen months' work. The war has not injured Calgary's prospects of getting her proposed batch of new Federal buildings. The work on the new post-office alone will employ large numbers of men. In the industrial field, plans are being prepared for the proposed building of Messrs. Gutta Percha & Rubber, Limited.

In the last bulletin issued by the Canadian Society of Civil Engineers, it is stated that at the request of certain members the alleged employment of alien engineers in the Government service in Calgary has been looked into, but the matter was not found to be one in connection with which the Council could make representations. The Council has also had under consideration letters from certain City Engineers who allege unfair treatment by the employers. In this case also it was not found practicable to take any action.

Coming Events

The 21st session of the International Irrigation Congress is to be held at Calgary from October 5-9.

The fourth American Road Congress is to be held at Atlanta, Ga., November 9-13. The Executive Secretary is Mr. I. S. Pennybacker, Colorado Building, Washington.

The Royal Architectural Institute of Canada will hold their seventh annual meeting at Quebec, September 21-22. Mr. Alcide Chausse, of Montreal, is the Honorary Secretary.

The Seventh General Annual Assembly of the Royal Architectural Institute of Canada is to be held at Quebec, September 21-22 next. The president is Mr. J. H. G. Russell, of Winnipeg.

The annual convention of the Canadian Health Association will be held in Fort William, September 10-12. The members include medical men, engineers and public health workers from coast to coast.

The American Road Builders' Association will hold their Eleventh Annual Convention and Exhibition in Chicago, December 14-18. The Secretary is Mr. E. L. Powers, 150 Nassau Street, New York.

Business Notes

The Harland Engineering Company, power engineers and contractors, have removed from 26 Victoria Square to larger offices at 102 St. Antoine street, Montreal.

Messrs. Eberhard-Wood Manufacturing Company, manufacturers of ornamental and general iron work, held their annual excursion at Grimsby Beach, Ont., on Saturday, August 15. The party consisted of about one hundred. An attractive programme of sports was carried out.

The Ebsary Fireproofing Company (Confederation Life Building, Toronto) have awarded the contract for their new building at Caledonia, where the manufacture of their gypsum fireproofing materials will be carried on. Heretofore the materials have been brought in from the American factory.

A fire occurred recently at the premises of the Kerr Engine Company, Limited, Walkerville, Ont., but assurance is forthcoming from the firm that nothing was lost or damaged which will interfere with their filling orders for brass or iron valves, hydrants or other of the lines listed in their catalogue No. 5, issued recently. Such patterns as were lost were of engines, pumps and mill machinery.

The Toronto office of Herbert Morris Crane & Hoist Company, Limited, inform us that their English company has received contracts from the British War Office for a large quantity of lifting and shifting machinery. In order to prevent delay in the delivery of the goods, the cases are all tagged with labels bearing the name of the firm and the words, in large red capitals, "On War Service." Recent developments have shown the wisdom of the company's policy in carrying large stocks of this machinery. The Toronto office, of which Mr. Malcolm Meldrum is General Manager, is equipped to supply any demand. The Canadian branch has several miles of chain in stock and can make immediate delivery of any chain block up to thirty tons capacity and with any height of lift required. A large number of hand-operated, overhead travelling cranes are on hand.

The Movement of Tall Buildings

The recent statement of the Superintendent of Buildings of Chicago that virtually all of the immense buildings and sky-scrapers of the down-town district are out of plumb, calls attention to a peculiarity of tall buildings little realized and still less understood outside of the architectural and engineering professions. The common impression is that all heavy and massive structures are rigid, firm, and immovable; yet, in Chicago, according to the Department of Buildings, they have not one but scores of buildings like the leaning tower of Pisa, only they do not lean so much, thirty inches being the most that any of them are out of plumb.

So far from being firm and rigid, all tall buildings are subject to two distinct movements, and all heavy buildings erected on anything but bed rock have three distinct movements to their credit.

The City of Chicago, built as it is on sub-strata of clay, says Building Progress, furnishes the most interesting study of the movement of buildings, and the greatest number and variety of examples. All of the early sky-scrapers of that city were carried on floating foundations or on piles driven deep into the clay. These buildings without exception settled into the soil due to their weight, the distances they settled varying from three to over five inches. Many of these buildings, notably the Great Northern Hotel are partially carried on jacks and periodically levelled up as settlements occur, then, after all subsidence has taken place, and the buildings have finally come to rest, the jacks are removed and the foundation walls filled in with masonry.

That is one of the movements of buildings, then, settlement; but settlement takes place only in those buildings erected on floating foundations. When the footings are extended down to bed rock, as all footings for present day buildings in Chicago are, the amount of settlement that takes place is nil and may be disregarded.

But even buildings with their footings carried to bed rock lean or are racked out of plumb, and the taller the buildings the more they are likely to lean, although the amount they are out of plumb is seldom enough to endanger the structure. Recently the Building Commissioners of Chicago ordered the Unity Building straightened as it was "unsafe but not dangerous," being thirty inches out of plumb. In an interview they said: "It is impossible to prevent the big buildings here from leaning. Some of them are not straight when they are finished, but that does not impair their safety. It is probably safe to say that every building in the city leans more or less. If they are on floating foundations they also settle gradually." But there is still another movement of buildings, and the most interesting of them all to consider. According to an exchange, "The Eiffel Tower swings perceptibly in the wind, and even stone shafts like those of the Bunker Hill and Washington monuments move several inches at the top. In these cases the cause of the action is not only the wind, but the heat of the sun. The side that is towards the sun expands during the day more than the side in shadow. An interesting device has been employed to show the movement of the dome of the Capitol at Washington. A wire was hung from the middle of the dome inside the building down to the floor of the rotunda, and on the lower end of the wire was hung a 25-pound plumb bob. In the lower point of the weight was inserted a lead pencil, the point of which just touched the floor. A large sheet of paper was spread out beneath it. As the dome moved, it dragged the pencil over the paper every day. The mark made was in the form of an ellipse six inches long. The dome would start moving in the morning as soon as the rays of the sun began to act upon it; and slowly, as the day advanced, the pencil would be dragged in a curve across the paper until sundown, when a reaction would take place and the pencil would move back again to its starting point. But it would not go back over its own pencil track, for the cool air of night would cause the dome to contract as much on the one side as the sun had made it expand on the other, and so the pencil would form the other half of the ellipse, getting back to the original point all ready to start out again at sunrise."

In the three movements affecting tall and heavy buildings we have, then, particularly in the expansion and contraction movement which is of daily occurrence, and which affect sky-scraper buildings as well as all other tall structures, a condition which must be taken into consideration when planning the buildings. Lines of steam pipes, stacks of drainage pipes, lengths of water pipes, vacuum cleaning pipes, refrigeration system pipes, electric wire conduits and the various networks of tubing which cross and criss cross inside of a building will naturally be more or less affected by the movements of the building; and if long life is expected of these various systems of piping, they must be so installed that they can "give" under the movements of the building without damage to the piping, and sufficient to compensate for the change of position.

Besides pointing out the necessity for flexibility for the piping systems in tall buildings, the movement of buildings shows how desirable it is to have solid foundations the footings of which extend down to bed rock. Floating foundations are all right for some kinds of buildings, but for the sky-scraper type there is nothing so good as the solid rock of old Mother Earth.

The Royal Architectural Institute of Canada will hold their seventh general annual assembly at Quebec September 21-22, 1914. At the inaugural session addresses by His Worship the Mayor of Quebec, the President of the Quebec Section of the Province of Quebec Association of Architects, and the President of the Quebec Builders' Exchange will be responded to by J. H. G. Russell, President of the R. A. I. C. On the afternoon of the second day V. J. Elmont will read a paper on "The application of Reinforced Concrete to Dome Structure." Arrangements have been made for complimentary luncheons by J. P. Oullet, and the architects of Quebec City; also an automobile trip to the various points of interest in this old historic town. Further information may be secured from Alcide Chausse, Hon. Secretary, 5 Beaver Hall Square, Montreal.

The Canada Carbide Company, Limited, which is closely associated with the Shawinigan Water & Power Company, is reported to have received some large orders for export business in the last few days. It is probable that the company's activities will be stimulated for some time to come by the blockade in Germany's export business.

Tenders and For Sale Department

TENDERS

Sealed tenders will be received by the undersigned up to noon, **Monday, the 7th day of September, 1914**, for the purchase of $22,152.27—20-year 5½ per cent. annual payment Village of Weston Sewerage Debentures. The lowest or any tender not necessarily accepted.

J. H. TAYLOR, Clerk,
35 Weston, Ont.

Greater Winnipeg Water District

Tenders for Aqueduct Construction

Sealed tenders addressed to the undersigned will be received up to noon of **Saturday, 19th September, 1914**, for the construction of Eighty-five miles of concrete aqueduct in five sections of approximately equal length.

Plans, specifications and form of tender can be secured after July 20th, 1914, by application to the District accompanied by certified cheque for One Hundred Dollars payable to the District, which deposit will be returned upon submission of tender or return of documents.

Bidders may tender on any section or on any number of sections.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,
Chairman of Commissioners
901 Boyd Building,
Winnipeg, Man., July 6, 1914. 30-36

Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Peterborough, Ont.," will be received at this office until 4 p.m. on **Monday, September 14, 1914**, for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Peterborough, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, August 18, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—65372. 34-35

Tenders for Restaurant Privileges

Sealed tenders addressed to the undersigned, marked on envelope "Tenders for Restaurant Privileges," will be received up to 12 o'clock noon, **September 15, 1914**, for the privileges for periods of one year, two years, five years, at the following places—leases to become effective from the dates mentioned.

Timagami Restaurant—from February 10, 1915.
Englehart Restaurant—from October 1, 1914.
Cochrane Restaurant—not yet opened.

Parties tendering will be required, if found necessary, to furnish bond that any agreements entered into will be carried out.

Highest or any tender not necessarily accepted.

Dated at Toronto this 22nd day of August, A.D. 1914.

A. J. McGEE, Secretary-Treasurer,
T. & N. O. Railway Commission,
35-36 25 Toronto St., Toronto.

Sealed tenders addressed to the undersigned, and endorsed "Tender for Extension of South West Breakwater at Goderich, Ont.," will be received at this office until 4 p.m., on **Friday, September 11, 1914**, for the construction of harbour improvements, being an extension to the South West Breakwater at Goderich, Huron County, Ont.

Plans and forms of contract can be seen and specification and forms of tender obtained at this Department and at the offices of the District Engineers, Windsor, Ont.; Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Goderich, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

NOTE.—Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $25.00, made payable to the order of the Honourable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, August 21, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—65626. 34-5

Tenders Wanted

For competitive plans and specifications for a Carnegie Public Library Building complete with equipment, at a cost of $15,000. Architects to state price for plans and specifications complete if Council decides not to employ architect to supervise building. No plans necessarily accepted.

Tenders to be received not later than September 19th, 1914, and to be addressed to E. Donnell, Town Clerk, Barrie, Ont.

Barrie, August 25th, 1914. 35-36

TOWNSHIP OF MINTO

Tenders Wanted

Sealed tenders marked "Tender for Drain No. 5, Minto," will be received by the undersigned up to 2 p.m. on **Monday, September 14th, 1914**.

The Council will proceed to consider the tenders immediately after the above hour at the Township Hall, Minto.

Plan, profile and specifications can be seen at the Clerk's office or at the office of C. D. Bowman, Esq., O.L.S., West Montrose.

The drain commences on lot 114, Con. D. and has its outlet on lot 23, Con. 3, Minto, and is nearly six miles long.

The lowest or any tender not necessarily accepted. A deposit of $400, cash or marked cheque, is required to accompany each tender.

W. D. McLELLAN,
Clerk, Township of Minto.
Harriston, Ont.
Harriston, August 31st, 1914. 35-36

Sealed tenders addressed to the undersigned, and endorsed "Tender for Electric Elevator, etc., for the Public Building, Brantford, Ont.," will be received at this office until 4 p.m. on **Wednesday, September 16, 1914**, for the installation of an electric passenger elevator to include motor generator set, etc.

Plans, specification and form of contract can be seen and forms of tender obtained on application to Mr. G. W. Hall, Supervising Architect, Brantford, Ont., at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, August 27, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—66051. 35-36

Municipalities and others sending in tender advertisements for the Contract Record are requested to bear in mind that these must be in our hands by ***Ten o'clock on Tuesday morning,*** each week, in order to be published in the issue of the following day.

JUDICIAL SALE

of the Assets of

The Canadian Mineral Rubber Co. LIMITED

In the matter of the Winding-Up Act, being Chapter 144 of the Revised Statutes of Canada and Amending Acts, and in the matter of the Canadian Mineral Rubber Company, Limited.

Sealed tenders will be received addressed to "George O. Alcorn, Esq., Master-in-Ordinary, Osgoode Hall, Toronto, Canada," and marked "Tenders in the matter of The Canadian Mineral Rubber Company, Limited," up to 2.30 p.m. of Friday, the 18th day of September, 1914, for the purchase of certain assets of the said Company consisting of:—

PARCEL No. 1—Located at Model City, adjoining Montreal, and at Sorel, Que.

Cummer asphalt paving plant, railroad type, and sundry accessories including rollers, concrete mixers, tank cars, tools, etc., etc.

PARCEL No. 2—Located at Winnipeg, Manitoba.

Roofing and flooring material and equipment, paint, pipe-coating, office furniture, safe, etc., etc.

PARCEL No. 3—Located at Calgary, Alberta.

Merriman asphalt paving plant, railroad type, and sundry accessories, including roller, stone crusher, concrete mixers, hoisting engine, tools, asphalt, cobbles, office furniture, etc., etc., together with a certain lease of dredging rights for sand and gravel, the liabilities under which must be assumed by the purchaser.

PARCEL No. 4—Located at Vancouver, British Columbia.

Cummer asphalt paving plant, railroad type, and sundry accessories, including rollers, stone crusher, concrete mixers, hoisting engine, tools, asphalt, rock, office furniture, motor-cycle, etc., etc.

PARCEL No. 5—Located at New Westminster, British Columbia.

Merriman asphalt paving plant, railroad type, and sundry accessories, tools, etc., etc.

PARCEL No. 6—Located at Victoria, British Columbia.

Merriman asphalt paving plant, railroad type, and sundry accessories, including rollers, concrete mixers, graders, automobiles, tools, supplies, office furniture, etc., etc.

PARCEL No. 7—Located in the State of Utah, U.S.A.

Certain claims and mining rights covering a deposit of practically pure bitumen (gilsonite) and bituminous limestone.

Possession. Immediate possession of parcels Nos. 1, 2, 3, 4, 5, and 7 can be given on completion of sale. Possession of parcel No. 6 cannot be given until certain paving at the City of Victoria, B.C., in which the Liquidator is at present engaged, is completed. If, before the completion of the sale, the purchaser requires possession of any parcel, of which possession can be given by the Liquidator, he may obtain same by giving security for the unmatured payments satisfactory to the Master-in-Ordinary of the Supreme Court of Ontario. Tenders must be made on the understanding that inability on the part of the Liquidator to deliver possession of, or transfer the title to any item shall operate as a cancellation of the sale in respect of such item only, and shall not operate as a cancellation of the sale as a whole. The amount of any allowance to be made in respect of any such item shall be determined by the Master-in-Ordinary of the Supreme Court of Ontario.

Tenders will be received for all parcels en bloc and for each parcel separately.

All rentals, taxes, insurance, water rates, and similar items will be adjusted to the date of the acceptance of the tender.

Full information as to all parcels with inventories of parcels Nos. 1, 2, 3, 4, 5 and 6, and a schedule of the claims and mining rights included in parcel No. 7, and copies of the Lease referred to in Parcel No. 3, may be obtained from the Liquidator,

NATIONAL TRUST COMPANY, LIMITED, TORONTO, CANADA.

Terms of Payment. Ten per cent. of the amount tendered shall accompany each tender, 15 per cent. on the acceptance of the tender, and the remainder in 3 equal instalments at 3, 6 and 9 months without interest. On receipt by the Liquidator of the final payment, the sale shall be completed. All tenders must be accompanied by an accepted cheque payable to the Liquidator for 10 per cent. of the amount of the whole tender, which cheque will be returned if the tender is not accepted, and forfeited if the tender is accepted, and purchase not completed by the tenderer.

The highest or any tender not necessarily accepted.

The purchaser shall, at his own expense, make whatever search of title he may deem necessary or expedient, and the Liquidator shall not be required to furnish any abstracts or produce any deeds, declarations, or other evidence of title except those in its possession. The purchaser shall have 15 days from the date of acceptance of tender within which to make any objections or requisitions in respect of the title and in case the purchaser shall, within such time make any objection or requisition which the Liquidator shall from any cause, be unable or unwilling to remove or answer, then the Liquidator may (notwithstanding any intermediate negotiations) rescind the sale, in which case the purchaser shall be entitled only to a return of the deposit money without interest, costs or compensation.

The other conditions will be the standing conditions of sale of the Supreme Court of Ontario as far as applicable.

Tenders will be opened at the office of the Master-in-Ordinary, Osgoode Hall, Toronto, Can., at 2.30 p.m., on the 18th day of September, 1914, when all tenderers are requested to be present.

Dated at Toronto, this 10th day of July, 1914.

NATIONAL TRUST COMPANY, LIMITED,
Toronto, Ontario, Canada,
Liquidator.

30-31-33-35

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board will be received until

Friday, September 11th, 1914

for

New Building, Margueretta St.

New Building, Carlaw Avenue

New Building, Euclid Avenue

Enlargement of John Fisher School

House Moving Work, Williamson Road

Cabinet Work

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

All tenders must be on revised forms.

W. W. HODGSON,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer.

35

FOR SALE

One travelling Derrick, 3 drums and swinger, 65 ft. Boom, 7 x 12 Engines; Beatty make. One 1-yd. Owens Clam Shell Bucket. All in splendid working condition.

GUTTERIDGE & GRACE,
Sarnia, Ont.

35-36

FOR SALE—One "Smith" concrete mixer in first class condition. Cost $950. Will sell for $600 cash. Apply Box 72, Contract Record, Board of Trade Building, Montreal 33-36

For Sale.—One Kemp Continuous Mixer, capacity guaranteed 15 cu. yds. per hour, steam, own traction, practically new. Price $600, f.o.b. shipping point. Address John H. Gordon, Albany, N.Y. 34-35

Positions Wanted

Position wanted by a first class artificial marble worker. Imitation guaranteed with all the modern commercial improvements. Ready to take charge of any job. References given. Box 337, Calgary, Alta. 35-36

Position wanted by reliable waterworks and sewers construction foreman. Good draughtsman; knowledge of transit and level; excellent references. Box 69, Contract Record, Toronto. 31-34

Agents Wanted

Large firm making diaphragm pumps with improved patent valves wants to secure agents in Canada. Pumps made in all capacities up to 14,000 gallons per hour. Workable by hand or mechanical power. Address Box 70, Contract Record & Engineering Review, Toronto. 32-37

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brampton, Ont.
The town council has passed by-laws to construct a number of permanent pavements and sidewalks.

Binbrook, Ont.
Tenders for the construction of pavements will be received by Mr. W. B. Switzer, Glanford Station, clerk to the township council, until Sept. 8th. Plans and specifications are with Mr. Robert Young, Binbrook.

Barrie, Ont.
The town council has decided to start work on the laying of glazed sewer tile pipe on James, Ross and Sophia streets. The work will be done by day labor under the supervision of the town engineer, Mr. K. K. Macdonell.

Bagotville, Que.
The work on the construction of the macadam roadway is being done by day labor under the supervision of the engineer, Mr. J. H. Clareau, Chicoutimi.

Calgary, Alta.
The by-law recently submitted to the ratepayers, asking for authority for the expenditure of $35,000 on extensions to the waterworks in North Calgary and the Belfast sub-division has been defeated.

Goderich, Ont.
Bids are invited until Sept. 11 by Secretary, Dept. Pub. Works, Ottawa, for constructing an extension to southwest breakwater at Goderich.

Hamilton, Ont.
Tenders will be received by the Mayor, until September 3rd, for the construction of sewers on Beulah Court, South St., Shaw Street, Cheever Street, Agnes St. and Campbell Avenue. Plans and specifications are at the office of the engineer, A. F. Macallum.

Minto, Ont.
Tenders will be received by the clerk of the township council, W. D. McLellan, Harrison, Ont., until 2 p.m., September 14th, for nearly six miles of drainage construction work. Plans, specifications, etc., may be inspected at the office of the Clerk, or of C. D. Bowman, O. L. S., West Montrose.

Oshawa, Ont.
Surveys have been made by the town council for the construction of cement concrete pavement on Simcoe street north. The estimated cost is $7,500. Mr. Frank Chappell, C.E., is the engineer in charge.

Regina, Sask.
The Provincial Highway Commission is planning to spend the sum of $500,000 on roadwork in the southern part of the province this fall.

St. John, N.B.
Bids are desired until October 7 (extension of date from August 26) by Secretary, Dept. Public Works, Ottawa, Ont., for constructing an extension to breakwater at Negro Point, St. John County, N.B.

Tenders will be received by the clerk to the city council, Mr. H. E. Wardroper, City Hall, until noon Sept. 5th, for the construction of a concrete retaining wall and sidewalk on Tower St. W., concrete sidewalk on Lombard St., and concrete base and sidewalk on north side Queen Square. Plans and specifications are at the office of the Commissioner of Works, Mr. F. L. Potts.

South Vancouver, B.C.
The municipal council has in contemplation the paving of Joyce Avenue, from Wellington to Price Street, at an estimated expenditure of $2,522. J. B. Springford is the clerk.

CONTRACTS AWARDED

Sandwich, Ont.
The town council has awarded a contract to the Canadian Dolarway Paving Co., of Windsor, to pave Bedford St., from End St. to the southerly limits of the town.

Sandwich East Twp., Ont.
The township council has awarded to the Canadian Dolarway Paving Co., of Windsor, the contract to pave Walker Rd. from Tecumseh Rd., to the 3rd Concession road, and on the 3rd Concession Road, from Walker Road to Pillette Rd.

Toronto, Ont.
The contract for the construction of an addition to the high-level pumping station has been let to Messrs. Page & Company by the Board of Control. The work which will cost about $36,600, will be proceeded with at once.

Weston, Ont.
The York County Board of Highway Commissioners has awarded to the Constructing & Paving Company, of Confed. Life Bldg., Toronto, the contract for road construction. The work is to be started immediately.

Railroads, Bridges and Wharves

Calgary, Alta.
The ratepayers have refused to endorse the by-law which called for the expenditure of $165,000 on the construction of a reinforced concrete bridge over the Bow River.

London, Ont.
Tenders will be received by the Board of Control until 9 a.m. September 4th, for the construction of a reinforced concrete floor for the Wharncliffe Road bridge. Plans and specifications are with the engineer, Mr. W. M. Ashplant.

Marieville, Que.
Tenders will be received by Mr. H. Ste. Marie, the secretary-treasurer to the municipal council until 1 p.m. September 8th, for the construction of two bridges of reinforced concrete.

Negropoint, N.B.
The time for receiving tenders for the construction of the extensions to the breakwater has been extended to 4 p.m. October 7th. Plans, etc., are at the office of Dist. Engr. at St. John, N.B., Halifax, N.S. Post Office, Quebec, Que., Shaughnessy Bldg., Montreal, Confed. Life Bldg., Toronto, Ont., Postmaster, St. John, and at the Dept., Ottawa. Tenders should be addressed to Mr. R. C. Desrochers, secretary to the Public Works Dept., Ottawa.

St. Catharines, Ont.
By a majority of 313 the ratepayers of St. Catharines have passed a by-law to construct a high-level bridge across the old canal from St. Paul street to Western Hill, near the Grand Trunk Station. The bridge will be a steel structure with approaches, and will cost $220,000.

Three Rivers, Que.
Tenders will be received by the city clerk, Mr. Arthur Beliveau, City Hall, until Sept. 31st, for installation of electric conduits in La Lassale Academy and Ste. Ursule School. Plans and specifications are at the office of the architect, Mr. M. A. Pruneau, Hocheloga Bank Bldg.

Victoria, B.C.
Tenders will be called shortly by the city council for making the necessary repairs to Point Ellice Bridge. The estimated cost is $4,000.

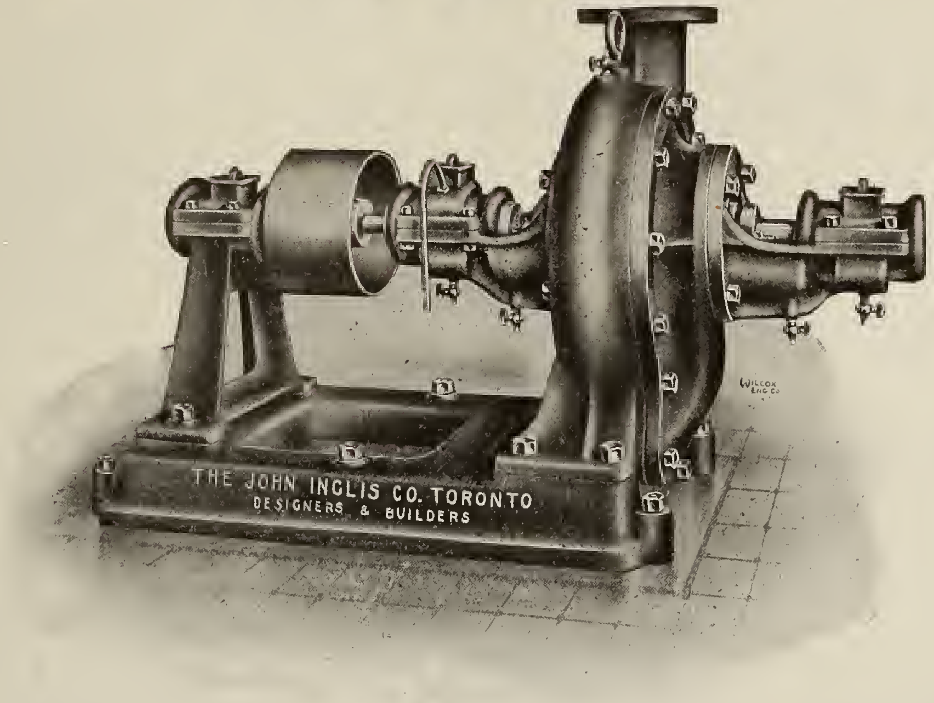
CONTRACTS AWARDED

St. Hyacinthe, Que.
The local contractor, Mr. Adelard Goselin has secured the contract for the construction of the bridge in Le Confesseur Parish.

St. Thomas, Ont.
The tender of the Imperial Wire & Cable Company, Montreal, has been accepted for the supply of 75,000 pounds of trolley wire for the London and Port Stanley Railway Commission. The Steel Corporation of Canada has been awarded the contract for track bolts, and that of the W. J. MacBeth Company for white oak for bridge ties, planking, etc.

New Glasgow, N.S.
The Eastern Steel Company, New Glasgow, N.S., is reported to have closed a contract to construct thirteen bridges in Nova Scotia.

PUMPS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Public Buildings, Churches, Schools, etc.

Barrie, Ont.
The library board are calling for competitive plans for the erection of the new library. Tenders will be received by the town clerk, Mr. Elijah Donnel, until September 19th. The estimated cost is $15,000.

Brantford, Ont.
Tenders for the installation of an elevator at the post office will be received by Mr. R. C. Desrochers, secretary to the Public Works Dept., Ottawa, until September 16th. Plans are at the office of the Dept., Station "F," Toronto, and G. W. Hall, Brantford.

Fonthill, Ont.
Plans are in progress in connection with the contemplated rebuilding of a church for the Holy Trinity congregation at an estimated outlay of $4,000. A building of brick and stucco construction, with electric lighting and hot air heating, is in contemplation. D. F. Forbes, Temple Building, Welland, is the architect.

Guelph, Ont.
Bids will soon be invited for erecting the building for the Physics Dept. at the Ontario Agricultural College; cost, $50,000.

Hagersville, Ont.
The W. A. Tom Construction Company, of Collingwood, who have the contract for the erection of the drill hall, are prepared to sublet some trades.

East Angus, Que.
Mr. R. C. Cowling, secretary to the Protestant Board of School Commissioners, will receive tenders until Sept. 8th, for the erection of a school building.

Hamilton, Ont.
Messrs. Stewart & Witton, of 2 Hughson street, the local architects, are inviting tenders for the erection of the Homewood school until Sept. 7th. The building is to be a 2-storey one of stone, concrete and brick construction, and will contain 16 rooms. The estimated cost is $100,000.

Keewatin, Ont.
According to the charter of the recently incorporated Lake of the Woods Golf Club Ltd., the company is empowered to erect the necessary buildings.

Lindsay, Ont.
Tenders for interior fittings at the post office will be received by Mr. R. C. Desrochers, at the Public Works Dept., Ottawa, until 4 p.m. Sept. 10th. Plans, specifications, etc., are at the offices of R. H. Bell, Clerk of Works, Lindsay, T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, and at the Dept., Ottawa.

Medicine Hat, Alta.
A permit has been issued for the erection of a temporary church for the Holy Trinity congregation. The building, which will be erected on the corner of Princess Avenue and East Allowance, will cost approximately $15,000.

Peterborough, Ont.
Bids are desired until Sept. 14 by Secretary, Dept. Pub. Works, Ottawa, Ont., for erecting a public building at Peterborough.

Quebec, Que.
Mr. Jos. Villineuve, 299 Prince Edward St., who has the contract for the erection of the presbytery of St. Roch's Parish, has sub-let the stone work to the Chateauvert Quarry Company, of 52 St. Paul street.

Sackville, N.B.
Plans are being prepared for the construction of the science building connected with the Mt. Allison University. The building is to be of stone construction, and is expected to cost about $45,000. The foundations are to be laid this year.

Saskatoon, Sask.
Work is about to start on the erection of the new post office at the corner of 4th Avenue and 23rd street. The engineer is now receiving prices for material. It is expected that the basement will be completed this year.

Toronto, Ont.
Bulk or separate tenders on the erection of the Christian Brother's school at Oak Ridges will be received by the architect, Mr. J. P. Hynes, 199 Yonge street, until Sept. 7th, and the Sutherland Construction Company, of the Ryrie Bldg., will receive tenders on different trades until Sept. 5th.

Vancouver, B.C.
Tenders have been called by the general contractors, Baker, Whipple & Campbell, 413 Granville Street, for the following in connection with the construction of a nurses' home for the General Hospital Board: 332 doors and frames; furnishing and installing fittings, etc., all mouldings, door and window trimming, and for labor in connection with placing the doors and frames, mouldings, door and window trimming. Plans and specifications are at the office of the general contractor.

The tenders on the erection of the Grandview drill hall being considered unsatisfactory, new tenders will be called shortly. The building is to be of two-storeys and basement, 240 ft. by 120 ft., of cut stone, reinforced concrete, brick and steel construction, and is estimated to cost $350,000.

Winnipeg, Man., Tuxedo
The ratepayers will be asked to vote on September 5th on a by-law which provides for the purchase of a site and the erection of a school building at a cost of $9,000.

Watford, Ont.
Bids will be received until Sept. 14 by the Secretary, Dept. Pub. Works, Ottawa, Ont., for erecting a public building at Watford.

CONTRACTS AWARDED

Barrie, Ont.
The Public Works Department has awarded to the W. A. Tom Construction Company, of Collingwood, the contract for the erection of the new drill hall.

Niagara Falls, Ont.
The contract has been awarded to W. P. Blair, Morrison street, for the construction of a lodge hall and offices for the I. O. O. F. on Queen and Ontario streets, at a cost of $40,000. The building will be four storeys, 107 x 50 feet, brick construction, store front, tiling. Bond & Smith, 5 Wilton Avenue, Toronto, are the architects. The contracts for heating, plumbing and electric lighting have not yet been let.

Simcoe, Ont.
The contract for the erection of the Trinity Church Parish hall has been awarded to Messrs. D. D. & L. A. Gunton.

Business Buildings and Industrial Plants

Brandon, Man.
The plans for the 10th street store for Mrs. Rose E. Forbes, have been altered and call for a one-storey building of brick construction. It is quite probable that another storey will be added later.

Caledonia, Ont.
The Ebsary Fireproofing Company, 447 Confed. Life Bldg., Toronto, is inviting tenders for the supply of mill equipment, including tracking kiln cars and turn tables, in connection with the mill for the manufacture of gypsum blocks now in course of construction at Caledonia. Mr. F. S. Bridges is the manager.

Hamilton, Ont.
Four money by-laws which were submitted to the ratepayers have been defeated. The by-laws were for the purpose of raising $175,000 for trunk sewers in the eastern part of the city, $50,000 for east and west end branches of the library, $125,000 for city hospital improvements, and $75,000 for the purchase of a stone quarry.

Niagara Falls, Ont.
The contract for roofing the new chain factory which the general contractors, S. Austin & Sons, Cleveland, Ohio, are erecting at a cost of $150,000, has not yet been let. The building is two storeys, 150 x 440 feet, stone, steel and reinforced concrete construction.

Oakville, Ont.
The erection of a garage and storehouse is being considered by Mr. W. Whittaker. The architect has not yet been appointed.

Quebec, Que.
It is understood that the Masson Company, of 17 Rasay street, will shortly erect a concrete and steel plant. All modern machinery will be installed.

Toronto, Ont.
A permit has been issued for the construction of a store front on St. Patrick street, at an estimated outlay of $2,000 for S. Back, 116 Dennison avenue.

Plans have been drawn for the construction of a detached residence on Manning avenue at an estimated cost of $4,500. Owner and general contractor, J. Robinson, 125 Lennox street. The building will be 20-storeys and of brick construction. Work has not yet been started.

The contract for heating and electric lighting has not yet been let in connection with the detached residence on Jackman Avenue for A. B. Turner, Lumsden Building, at a cost of $5,000. The general contractor is J. M. Walker, 195 Fulton Avenue.

Victoria, B.C.
A permit has been issued to J. F. Billinger for the construction of a residence

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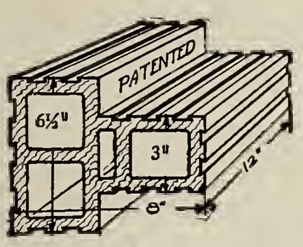

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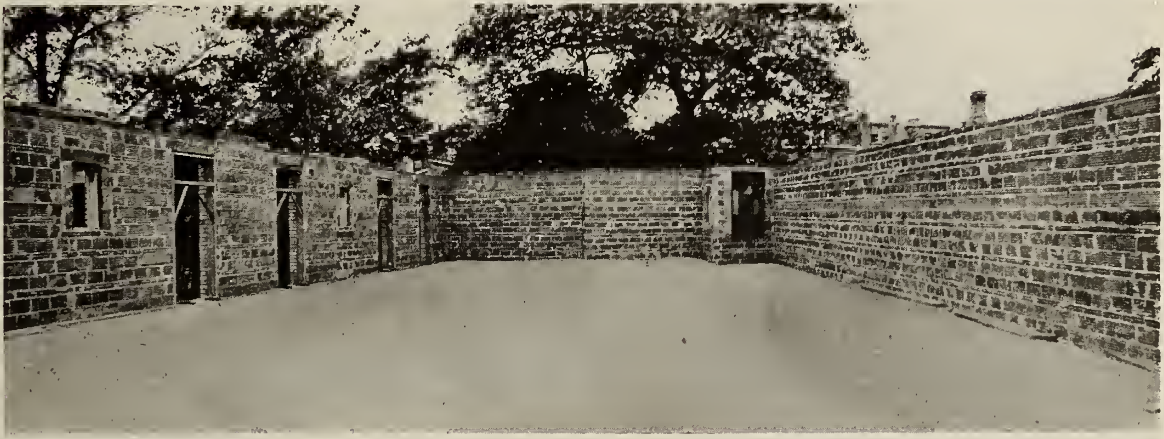

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Wm. Fraser, Architect — Chas. Nobes, Masonry Contractor

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Sun Brick Company, Limited

Traders Bank Building
TORONTO, ONT.

on McKenzie street, at an estimated cost of $2,500. Mr. Billinger is the architect and general contractor of the building, which will be of frame construction.

A permit has been issued for the building of a residence on Lot 25, Block 30-3, for the owner and architect, J. H. Renfree, 149 Rendall Street. The general contractor is Mr. J. White, and the building will be of frame construction.

A permit has been issued to Joseph Parker for the construction of a dwelling on Oxford street to cost $2,500.

Welland, Ont.
Plans are in progress at the hands of the architect, D. F. Forbes, Temple Building, for the construction of a $3,000 residence on Avenue Place for Chas. Baker.

The architect, D. F. Forbes, Temple Building, is preparing plans for a two-storey residence of brick construction, to be erected on Randolph street, for William Doney. The estimated cost is $5,000.

CONTRACTS AWARDED

Welland, Ont.
The contract for the erection of two stores on Bugar and Main streets for Mr. E. Z. White, has been awarded to Mr. Wm. Mitchell, of 120 Aqueduct street.

Windsor, Ont.
Mr. Leo Weis, of Detroit, Mich., U. S. A., has been successful in obtaining the contract for the erection of the new factory on Pitt street, for the J. T. Wing Company, of 61 Sandwich street east.

Residences

Chedoke, Ont.
Mr. Thos. Smith is having plans prepared for the erection of two residences of brick construction. Work will be started as soon as a suitable site is secured.

Montreal, Que., Notre Dame de Grace
Tenders close shortly with Holmes, Ltd., 357 St. Catherine W., for general contractor and separate tenders connected with the erection of a number of residences on Madison street.

Mr. Walter Livermaie, of 72 Anderson St., invites tenders on the erection of flats on Gerard St. The estimated cost is $8,000.

Oakville, Ont.
Messrs. George & Moorehouse, of 67 Victoria St., Toronto, are drawing plans for the erection of a residence on Reynolds street, for Mr. T. T. Harris.

Mr. Thos. Blakelock, the local architect, is drawing plans for the erection of a $5,000 residence for Mr. N. Lawrence.

Mr. A. F. Ford is preparing plans for the erection of a brick residence at the corner of Douglas Avenue and Summer Street.

Toronto, Ont.
The International Capitalists, Ltd., of 93 Queen St. E., are calling tenders for the erection of two residences of brick construction.

CONTRACTS AWARDED

Galt, Ont.
The following contracts have been awarded on the erection of a residence, at the corner of Barrie Road and Salisbury Avenue, for Mr. J. F. Roelofson. Cement, brick and masonry, Jas. T. Webster, Crombie St.; carpentry, Peter Nichol, Market St.

Peterborough, Ont.
The general contract for the erection of 5 residences on Rubridge street for Mr. Geo. W. Morran, has been awarded to Mr. J. G. Graham, 599 Water street.

Power Plants, Electricity and Telephones

Joliette, Que.
Tenders for the installation of a hydraulic plant will be received by the Sec.-Treas., A. L. Marsolais, until Sept. 16th. Plans and specifications are at the office of the engineers, Surveyor & Frigon, 56 Beaver Hall Hill, Montreal.

Kelowna, B.C.
The municipal council contemplates installing a new public telephone system as the present one is unsatisfactory. The estimated cost is $8,000. Mr. G. H. Dunn is the municipal clerk.

Queenston, Ont.
It is reported that an electrical power station for the Ontario Hydro-electric Commission, Toronto, is to be constructed at Queenston, Ont., capacity 250,000 electrical h.p., using waste waters of new Welland ship canal and 6,000 cu. ft. of Niagara River water.

Regina, Sask.
The following rural telephone companies have been empowered to borrow the amounts specified: Rainton, $6,300; Cedou, $5,000; Maymont, $9,000; Foxbury, $8,000.

Miscellaneous

Mahone Bay, N.S.
Tenders will be received by the Dep. Minister, Dom. Govt. Dept. of Marine & Fisheries, till Sept. 21st, for the construction of two wooden range light towers at Kaulbach Island. Plans and specifications are at the Dept., Ottawa, the agency of the department, Halifax, and at the post offices, Lunenburg, Mahone Bay, East River, Indian Point.

Moose Jaw, Sask.
Tenders will be received by the Parks Board until noon Sept. 10th, for the supply of fencing for the cemetery as follows: (1) 990 ft. of wrought iron fence, 52 ins. high, with the necessary gates and posts; (2) 990 ft. of wrought iron fence, 52 ins. high, with the necessary gates and posts, and erection of same; (3) 2,310 ft. of Greening's fabric fence, 52 ins. high, or fence of similar quality, with the necessary gates and posts; (4) 2,310 ft. of Greening's fabric fence, 52 ins. high, or fence of similar quality, with the necessary gates and posts, and erection of same. Plans and specifications are at the office of the engineer, Mr. G. D. Mackie.

Business Notes

Phoenix, B.C.
The business block of the Phoenix Miners' Union has been destroyed by fire. The loss is estimated at $30,000, of which $10,000 is covered by insurance.

Calgary, Alta.
The Calgary Oil Company's plant was recently damaged by fire to the extent of $30,000.

Ottawa, Ont.
The store of Mr. P. Stewart, 301 Bank St., has been destroyed by fire, and a loss of $12,000 involved. It is understood that the premises will be rebuilt.

Guelph, Ont.
The Victoria Skating Rink, the stables owned by Dr. W. F. Savage, Yarmouth St., have been destroyed by fire. The loss is estimated at $30,000.

New Companies

The provisional directors are Z. Mageau, J. U. Lamarre and J. M. Cousineau, all of Field, Ont.

The Dissette, MacConnell Lumber Company, Limited, has been incorporated, with a capital of $25,000, with head office at Vancouver, B.C.

Gillstrom Construction Company, Ltd., has been incorporated with a capital of $20,000, with head office at Swift Current, Sask.

Forbes Electric Company, Limited, has been incorporated with a capital of $10,000, with head office at Saskatoon, Sask.

Plumbers Supplies, Limited, has been incorporated with a capital of $25,000, with head office at Calgary, Alta.

Dartmoor Limited, c/o Robins Limited, 105 Victoria street, has been incorporated with a capital of $162,000, with power to quarry stone, gravel and sand, also to manufacture clay products and cement. The company may conduct a general building business in addition.

Geo. M. Miller & Co.
Architects
Toronto General Trust Building TORONTO

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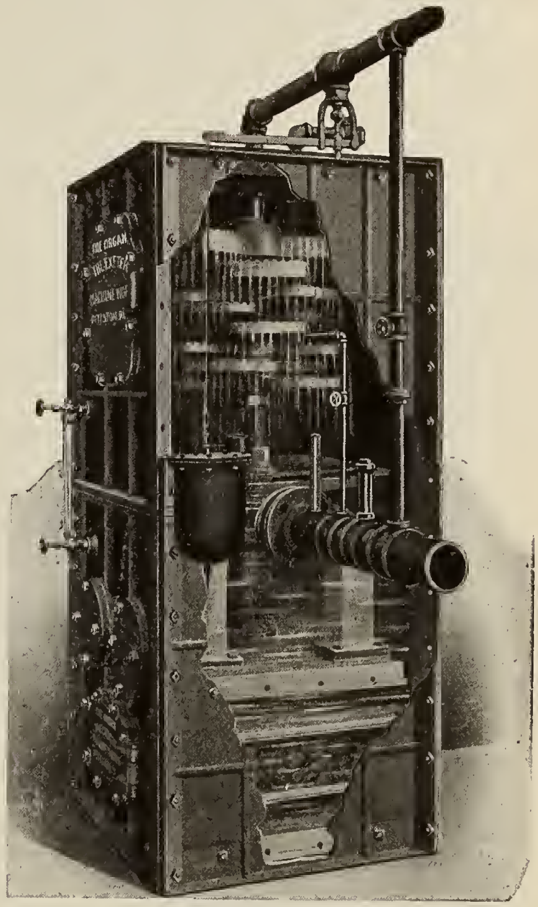
Combining in one apparatus Feed Water Heater and Purifier, Oil Separator, Drip Receiver and Expansion Tank.

IT is now well known that over 50% of the Steam Boilers in operation are defective in ways that can be traced to impure feed water. All feed water contains a certain amount of impurities; some of these can be precipitated by heating the water to about 200° F. If these substances do not precipitate, they will be deposited as scale, and it has been shown that scale 1/16 in. thick on the boiler heat transmitting surface increases the consumption of coal by 9%, while a deposit of ½ in. requires an increase of 60%. Practically all of these troubles can be eliminated by purifying the water before entering the boiler, which can be done by boiling.

The best, simplest, and most inexpensive methods of boiling or purifying the boiler feed water is by the use of an **Organ open Feedwater Heater and Purifier,** which will utilize the exhaust or waste steam and bring the water up to the boiling point. There are twelve points to be considered in buying **Feed Water Heaters and Purifiers.**



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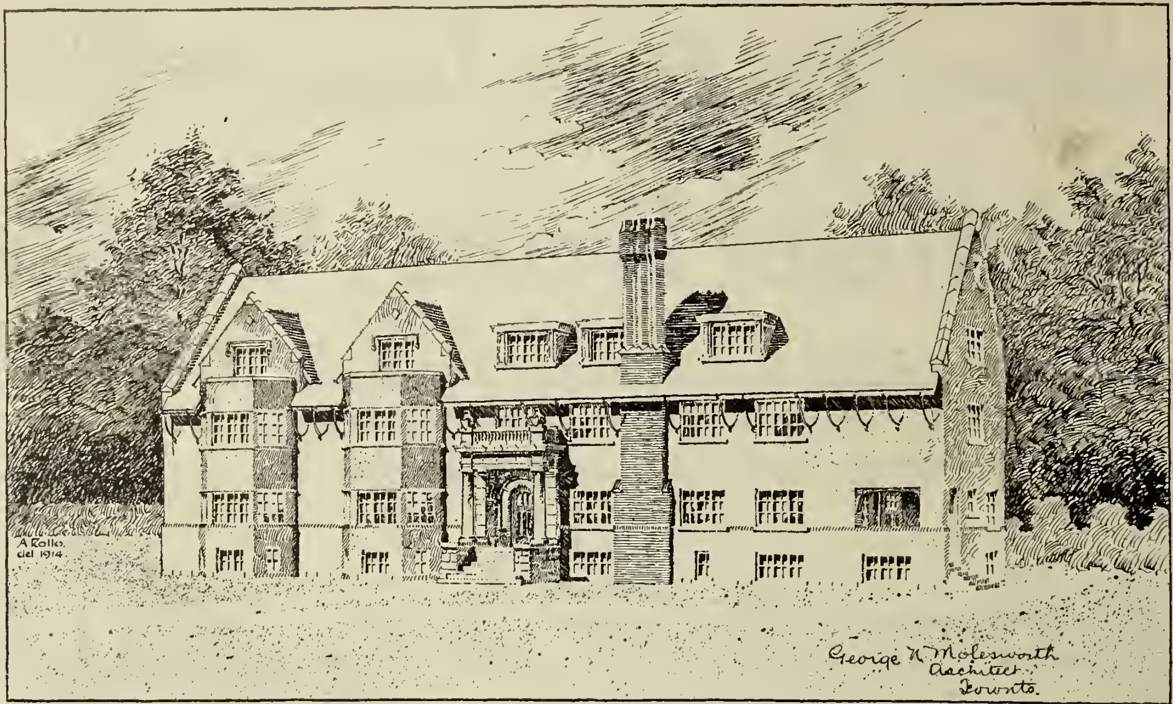
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UNDERPINNING A BRIDGE

A McKiernan-Terry Core Drill was successfully used on a job of underpinning in connection with the Grand Central Station improvements, New York, under most unusual conditions.

Owing to a settlement of the columns supporting the bridge crossing the yard at Fifty-fourth street, it was decided to provide a more secure foundation by underpinning them and extending the supports to bed-rock. With the core drill four 14-inch holes were drilled close together around each column and were driven through the concrete footing. Then 10-inch steel pipe was thrust through these drill holes into the soft material and was driven down until rock was reached. These holes were cleaned out and 5-inch core holes were put down a sufficient distance into the rock to insure a sound bottom. Reinforced concrete piles were then cast in the holes, and, by proper means, the columns were made to rest thereon.

This particular method of correcting the settlement of the columns was the only one which could be carried on without interrupting either the traffic in the yards or over the street bridge.

For other applications of Core Drills see Bulletin 512.

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Darling & Pierson, Architects

DOMINION BANK BUILDING
Darling & Pearson, Architect

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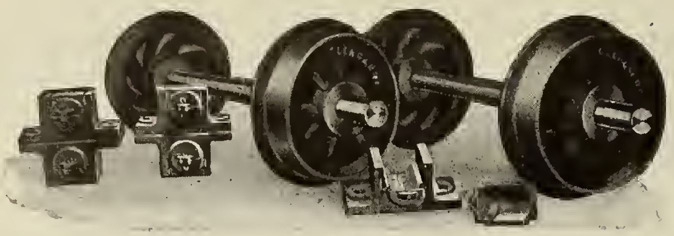

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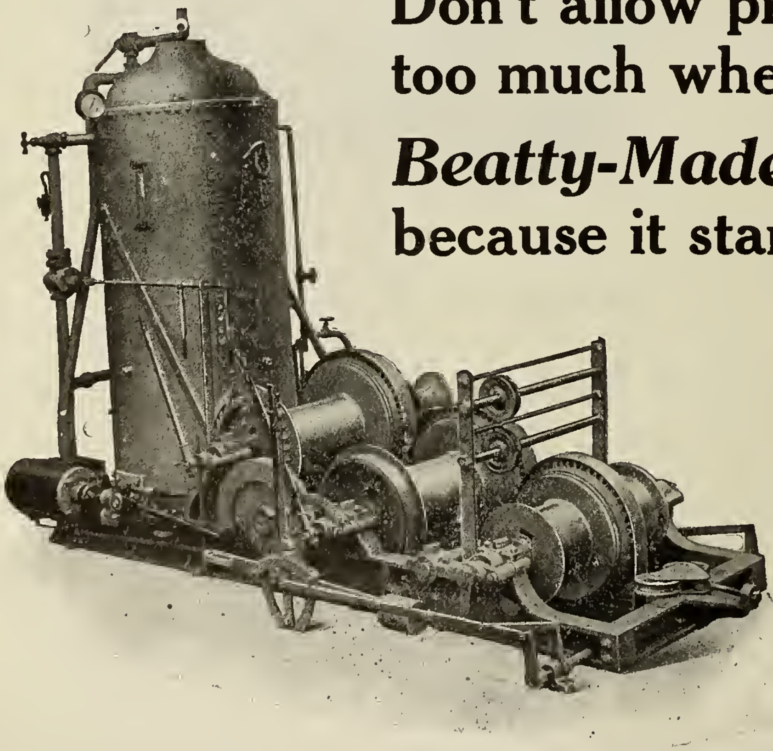

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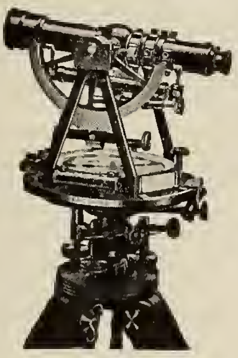

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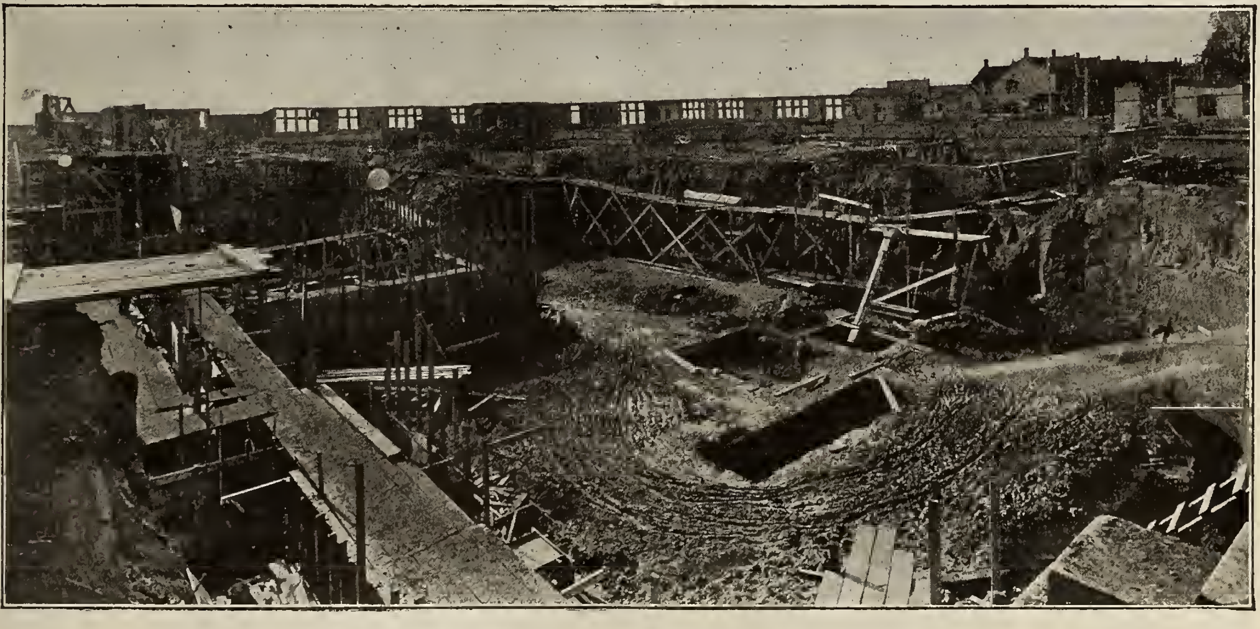

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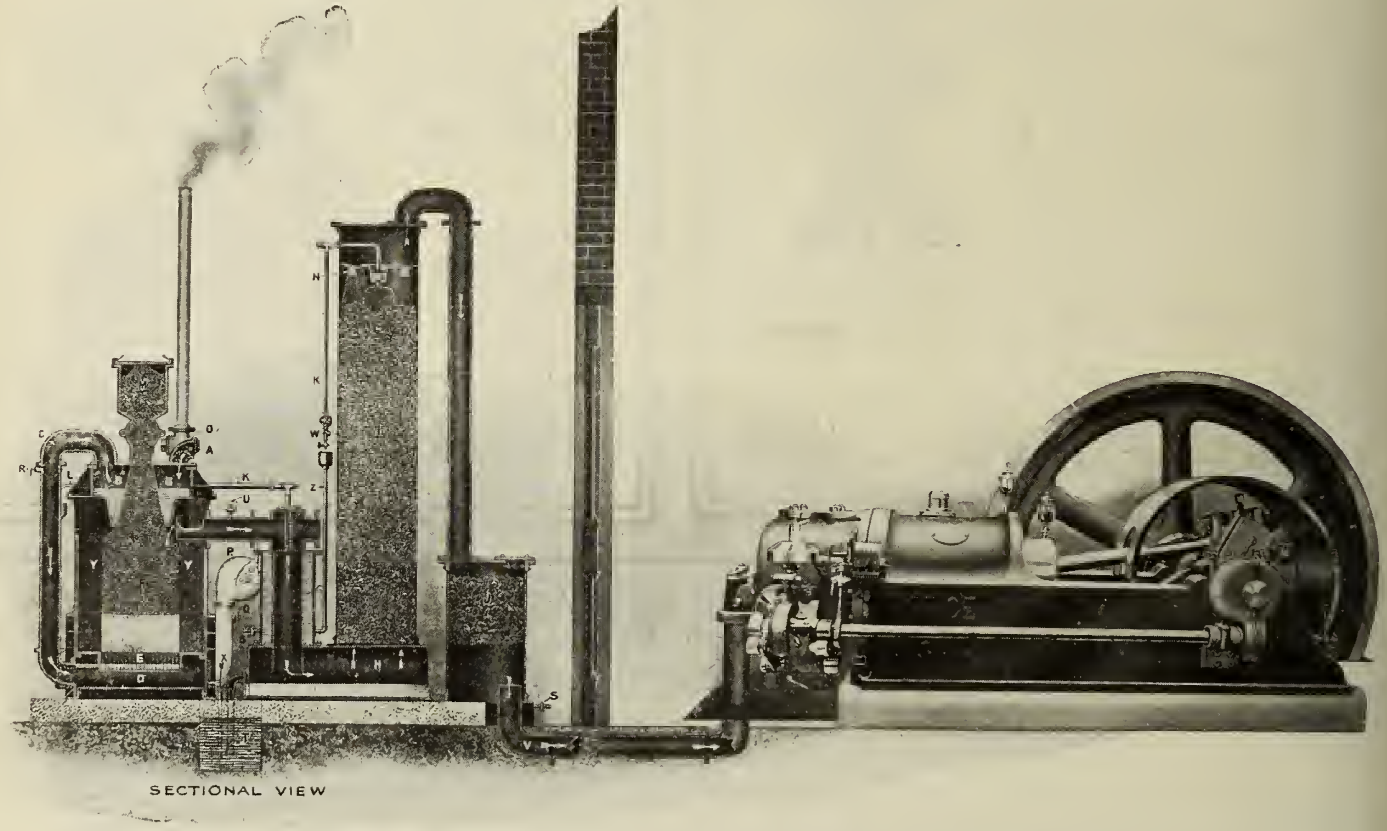

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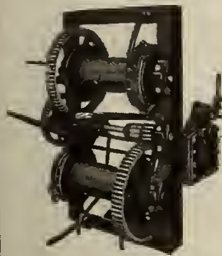
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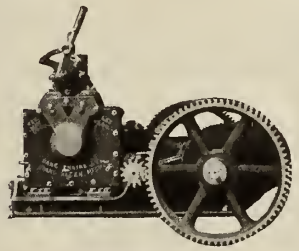
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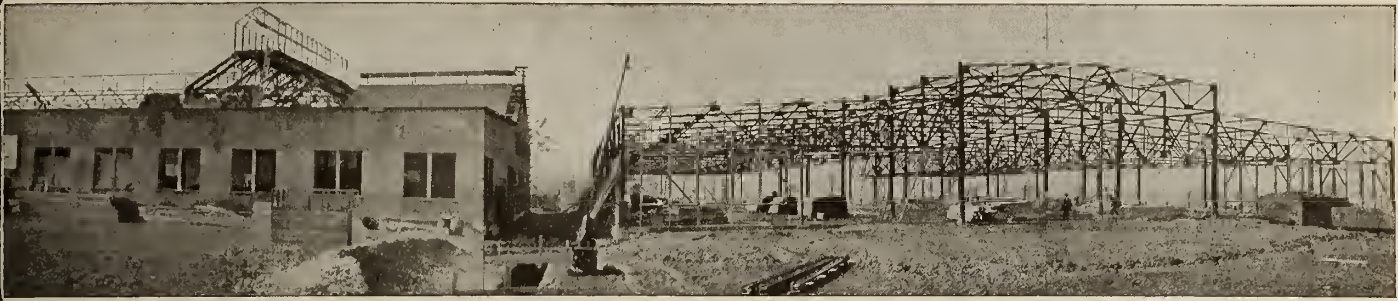

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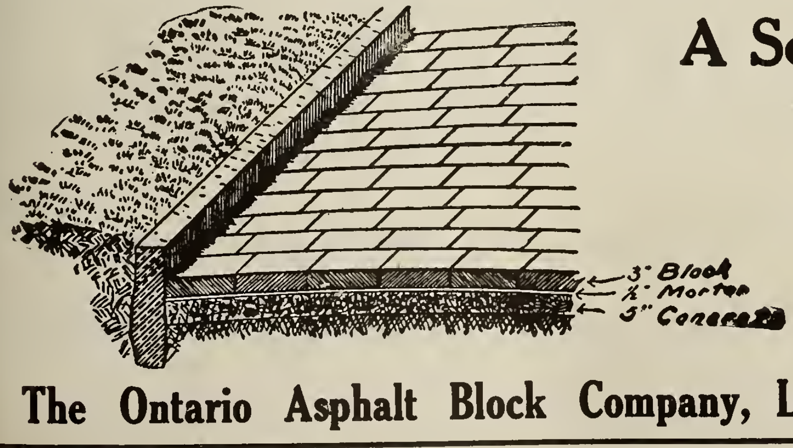

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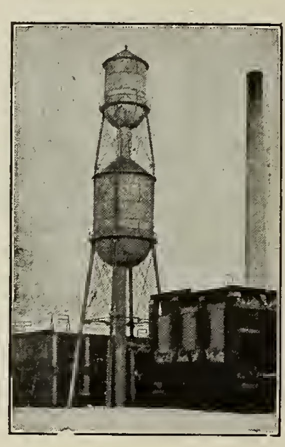

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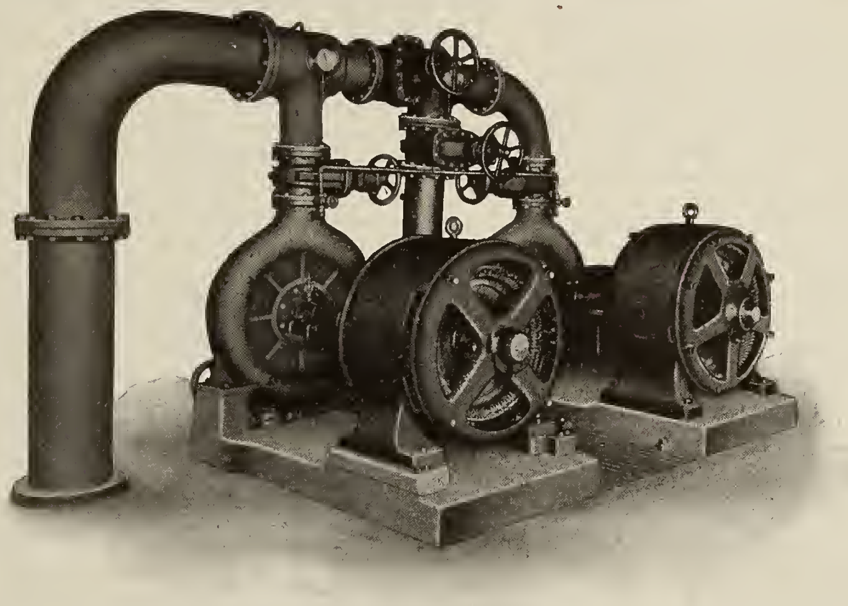

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CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $30; sand-lime brick, $8.10, King Edward Siding; $7 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

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Quotations withheld.

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

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Steel channels and beams, angles and plates—$4.

$2.50 to $3 per 100 pounds.

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Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

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White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 73c per gal. of 9 lbs.

Raw linseed oil—in bbls., 70c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 67c.

MONTREAL PRICES

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Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $24, red $24, buff $25, white $47, plain pressed $12 per thousand, all f.o.b. Montreal. Quotations f.o.b. Toronto:—White $52.50, buff $30, grey $27.50, plain pressed $17.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

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STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13c basis; African hemp, 13c; sisal rope 10½c basis. Boiled linseed oil—in barrels, 60c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, delivered, $13 per cord.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

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Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16,

(Continued on page 90)

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(Continued from p. 88.)

16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

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Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $8.85 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

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CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

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Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

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Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.15 to $3.65.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.15 to $3.65 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

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Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

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PAINTS AND OILS

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White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 90c per gal. of 9 lbs.

Raw linseed oil—in bbls., 88c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

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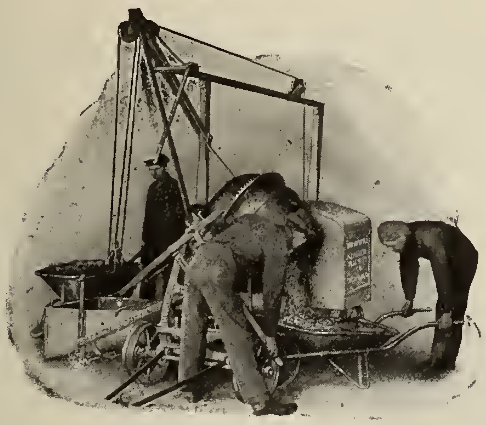

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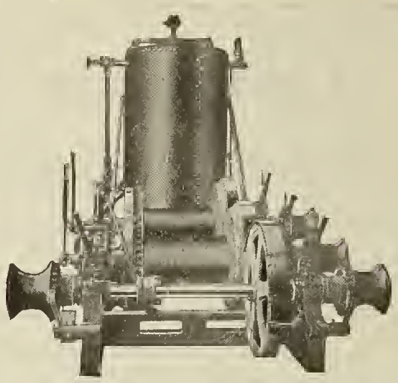

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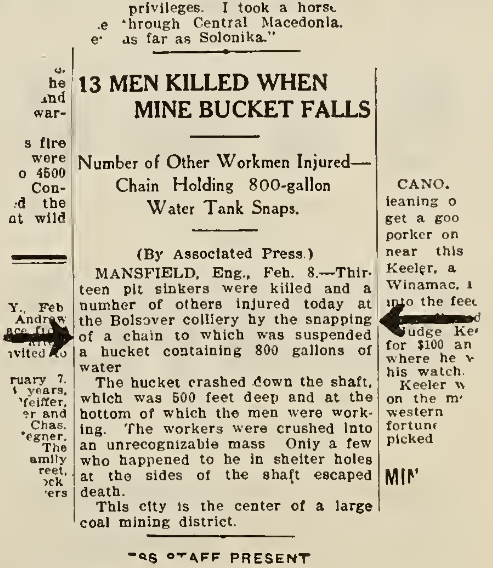

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(By Associated Press.)

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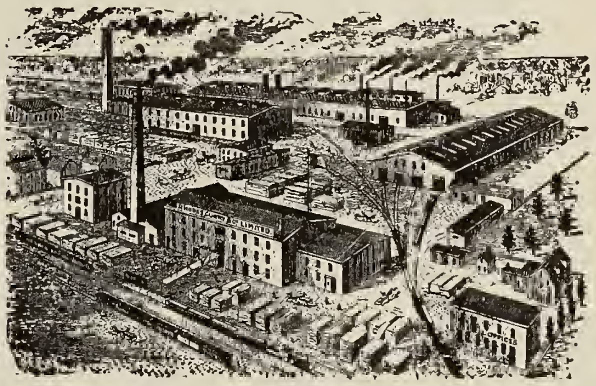

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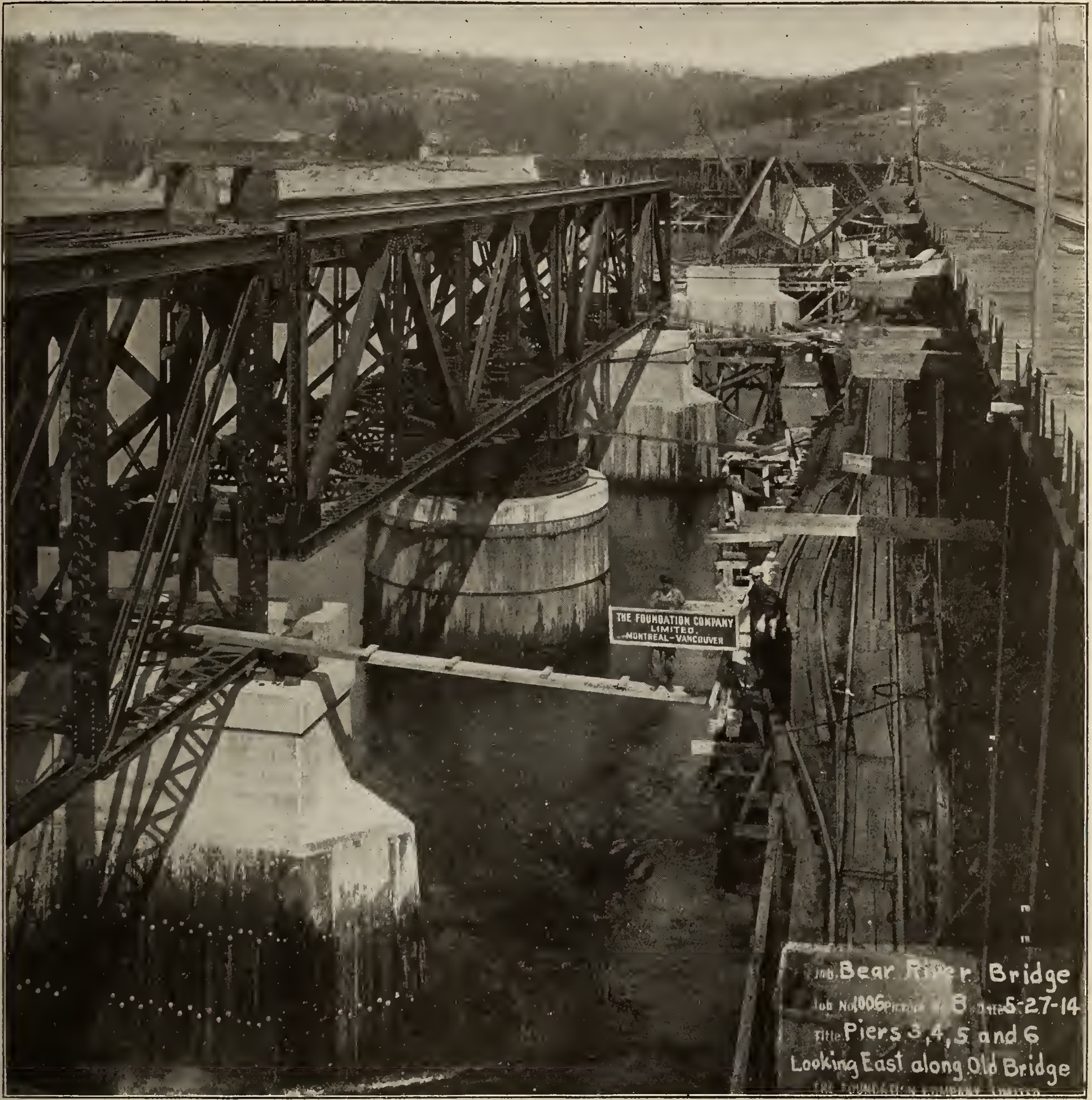

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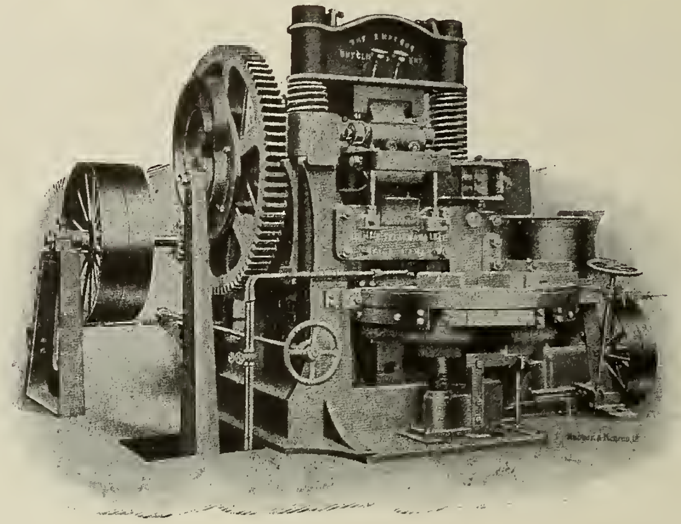
Clinker,

&c., &c.



Installed

Complete

on Best

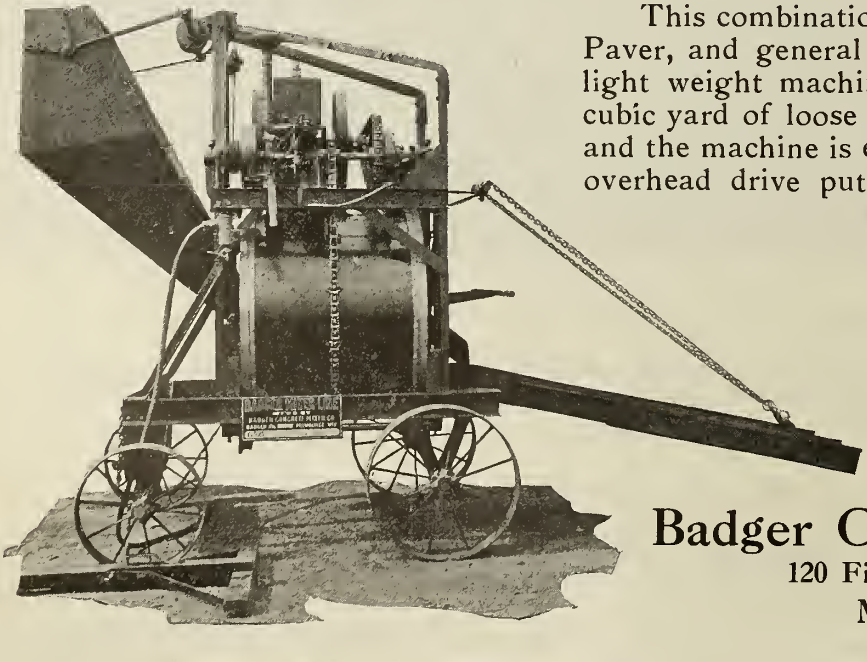
Lines.

World Wide Experience.

SUTCLIFFE, SPEAKMAN & CO., LTD. LEIGH,

CABLES—"Utilization Leigh" CODES—A B C. 5th Edn. McNeill 1899 Edn. **LANCASHIRE, ENG.**

Badger Road Builder Street Paver and Mixer



This combination Badger Road Builder, Street Paver, and general purpose Mixer, is an all-steel, light weight machine, with a capacity of one-half cubic yard of loose material. The wheels are high and the machine is easily moved by two men. The overhead drive puts the engine out of the way, enabling the crew to work on all sides. The Badger is the simplest, strongest and best designed road builder and street paver on the market. This is the only Mixer that will meet all the various requirements of the contractor for efficiency and general utility. No vibration.

Write for our prices—they will interest you.

Badger Concrete Mixer Co.

120 First National Bank Bldg.

Milwaukee, Wis.

THE H. & E. PATENT BALL-BEARING LIFTING JACK

For Railway and Bridge Work, Contractors' and Builders' Use

Made by practical Jack Builders. Material: best grades of malleable iron and steel. Fully guaranteed as to durability and efficiency. The long even stroke of the lever together with the design and careful construction of the Jack, makes it the quickest and easiest working lifting appliance on the market. Made in plain and foot-lift styles. Adapted to all classes of work where a lifting jack can be used. Sizes from 8 to 50 tons capacity now complete. Send for prices and discounts.

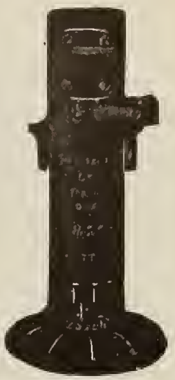
To any responsible Firm or Railway in Canada any of these jacks will be sent on 30 days trial.

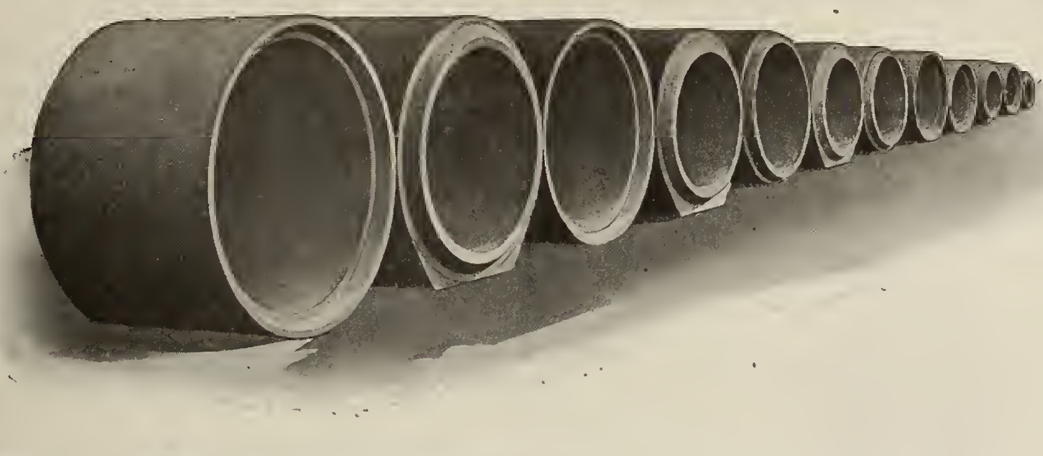
Manufactured by

CANADIAN BRAKESHOE CO., LIMITED
SHERBROOKE, QUE.

Sole representatives for the sale of our Brakeshoes in the Dominion of Canada outside British Columbia — Messrs. Taylor & Arnold, Montreal and Winnipeg. The Province of British Columbia—The B. C. Equipment Co., Vancouver.

Stock carried by F. H. Hopkins & Company, Montreal



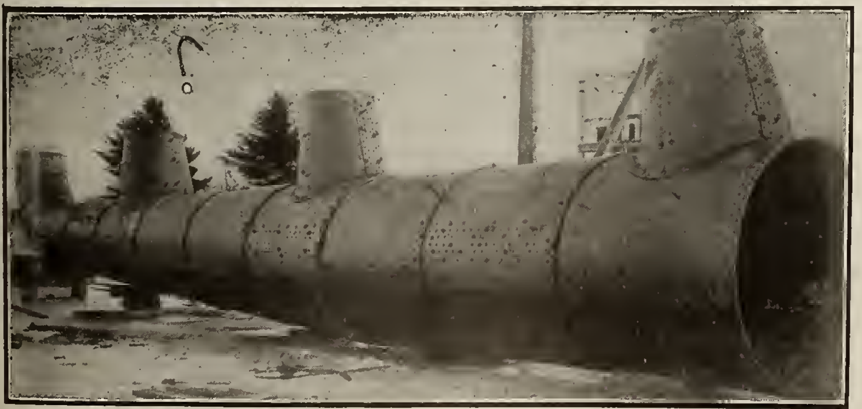


The Possibilities of Concrete

That the possibilities of concrete for building purposes are receiving recognition from architects and contractors is evidenced by the growing demand for this material. We are operating the most up-to-date plant in Ontario and make a special point of supplying ornamental trimmings for public buildings, churches and schools. Our manufactures include building blocks, silo blocks, concrete fence posts, railroad pipes and culvert and sewer pipes.

Your enquiries are respectfully solicited.

National Concrete Mfg. Company, Limited
LINDSAY, ONTARIO



Erected at Seven Falls, Quebec, Distributor Pipe and Branches, under 450 ft. Head.

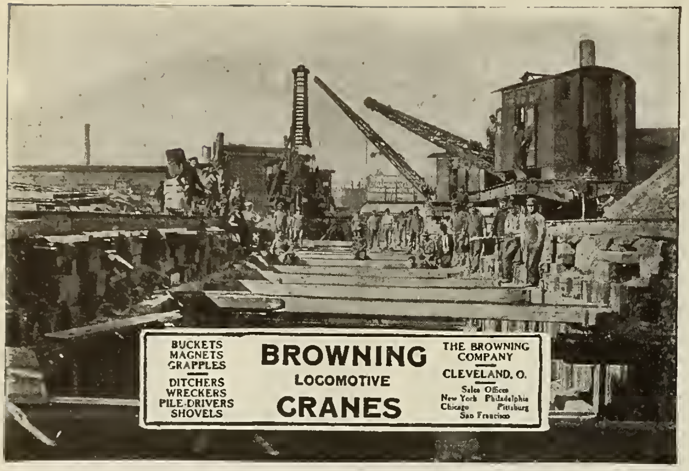
Structural and Steel Plate Work

is our specialty. We fabricate and erect from your drawings, or will design your structure for you.

No Work Too Large for us to handle in the minimum of time. May we estimate on your requirements?

WALSH PLATE & STRUCTURAL WORKS, LIMITED

Drummondville, Que. **Holyoke, Mass.**

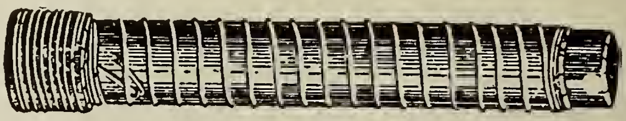


BUCKETS
MAGNETS
GRAPPLES

DITCHERS
WRECKERS
PILE-DRIVERS
SHOVELS

BROWNING
LOCOMOTIVE
CRANES

THE BROWNING COMPANY
CLEVELAND, O.
Sales Offices
New York Philadelphia
Chicago Pittsburg
San Francisco



Continuous and Machine Banded Wood Stave

WATER PIPE

Reservoir Tanks for city and town Water Systems, Fire Protection, Power Plants, Hydraulic Mining, Irrigation, etc. One-half the cost of Iron Pipe—and better.

Pacific Coast Pipe Co., Limited
P. O. Box 563 Vancouver, B. C.
Office and Factory, Granville St., near High Bridge
Write for Catalogue
Full Particulars and Estimates Furnished

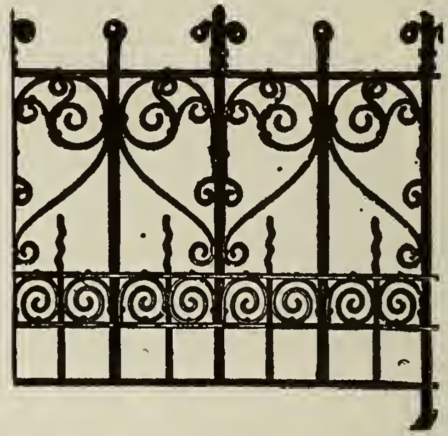
"Hammer Brand"

Hard Wall Plaster

HARD-WALL PLASTER
HAMMER
BRAND
HILLSBOROUGH, N.B.

It neither loosens nor falls off, it allows carpenters to follow plasterers without loss of time and lasts as long as the building.

Albert Manufacturing Co.
Hillsborough, New Brunswick, Canada



Iron Fences

Every conceivable style and design in ornamental iron fence work can be faithfully carried out by us.

Send in your specifications and get our quotations.

We also specialize in iron stair work.

The **GEO. B. MEADOWS**
Toronto Wire Iron and Brass Works Co., Limited
Meadows Block, Wellington St. W.
TORONTO, ONT.

Keiths LIMITED

Do YOU intend installing, or have YOU thought of REFRIGERATION as applied to YOUR needs or processes?

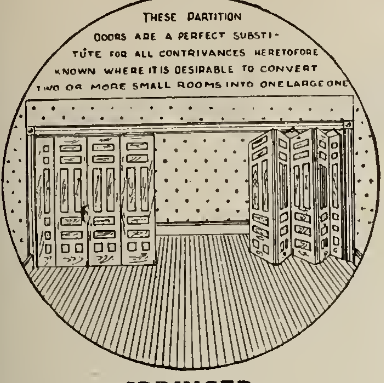
Refrigeration--Ice Making
Cold Storage

TORONTO &
MONTREAL

AGENTS
The
FRICK
Company,
WAYNESBORO,
PA.

If so write us at address as below for information on this subject. We are anxious to talk this matter over with you and to give you the benefit of 35 years' experience of refrigeration.

Our address is
Head Office: 297 Campbell Ave., Toronto
Quebec Office: 707 New Birks Bldg. Montreal


THESE PARTITION DOORS ARE A PERFECT SUBSTITUTE FOR ALL CONTRIVANCES HERETOFORE KNOWN WHERE IT IS DESIRABLE TO CONVERT TWO OR MORE SMALL ROOMS INTO ONE LARGE ONE

Points of Superiority which place

Springer's

Folding Door and Partition Hanger

before all other similar contrivances

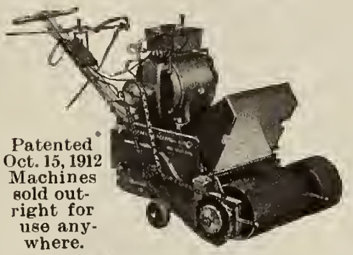
No track required on floor.
Perfect balance in all positions.
any width of sections may be used.

Plans and Full Information from

O. T. SPRINGER - Burlington, Ontario

THE AUTOMATIC BALL BEARING ELECTRIC FLOOR SURFACING MACHINE

Contractors and builders find, dresses in paying quantities, quarter-sawed oak, maple, etc., the way they want it or rapidly refinishes old floors. Having ballbearings, roller and dust-suction fans spin true and easy: yielding arms give flexible or rigid roller as needed; self-propelling with automatic control gauges roller cut for even work and brakes forward pull for large capacity —you simply guide. Surfaces to base baseboard with Edge Roller. No hand scraping. Booklet tells all about it and our



Patented Oct. 15, 1912
Machines sold outright for use anywhere.

FREE TRIAL OFFER

Made in several sizes for small rooms or large areas. Let us send you the names and addresses of Canadian owners near you.

Wayvell Chappell & Co.
Dept. F. 4845 Ravenswood Ave. **CHICAGO, ILL.**

Renfrew Lime

Will save you money

NOT because it is cheaper than other limes but because it has some advantages not found in other brands.

It is easily bedded down and does not set too rapidly, allowing the brick-layer to spread for more bricks. It requires but little time for tempering and sets hard as a rock.

Try "Renfrew" lime on your next job.

White Lime — Gray Lime
Stone — Drain Tile — Brick

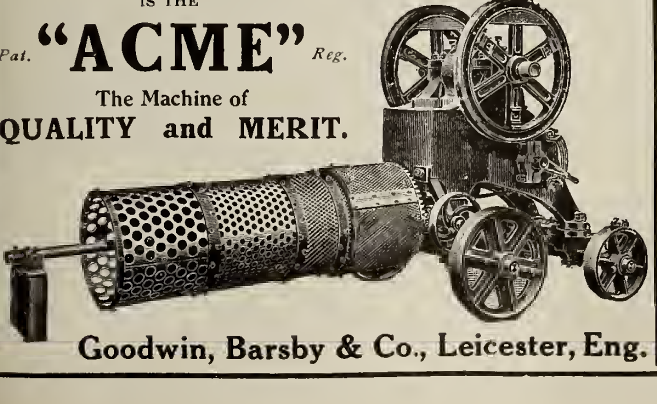
Jamieson Lime Company

Renfrew, Ontario

This **STONE CRUSHER** IS THE

Pat. **"ACME"** *Reg.*

The Machine of
QUALITY and MERIT.



Goodwin, Barsby & Co., Leicester, Eng.

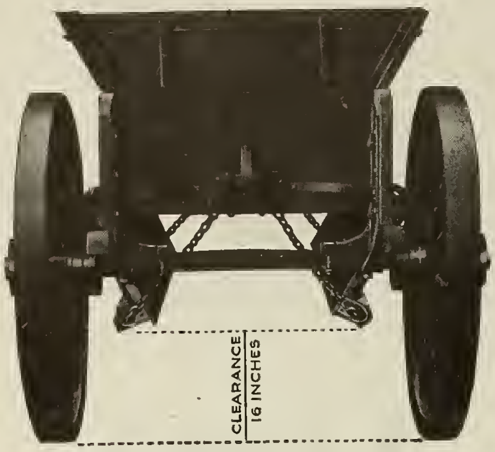
Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

The Last Ten Dollars



in a dump wagon is the best part of its price. When we chose the Watson Wagon we selected the highest priced dump wagon of the lot. You get exactly what you pay for in this world, and although other wagons can be bought for less we wanted the best so that we could go back to our customers with a clear conscience.

John Deere Plow Co. of Welland, Ltd.
77-79 Jarvis St., Toronto, Ont.

Buy the Brick of Proven Merit

By actual use in many structures and by scientific tests Harbour sand lime bricks have been proved an ideal building material.

Tests made at the University of Toronto at different times showed the crushing strength in pounds per square inch as: 4180, 4020, 4050, 4130. This is proof of uniformity in strength.

Harbour Brick Co., Limited
Lumsden Building
Toronto

CONTRACTORS' LOCOMOTIVES

Contractors' locomotives to justify their cost must start the required load and keep it going.

The right amount of the right material must be provided in the right place.

Each and every part must be sure to fit not only the locomotive for which it was made, but every other locomotive of the same size and design. Every part must be made to jigs and templets, compelling accuracy, so the machine will not be idle at a critical time for repairs or renewals. Spare parts must be instantly available, made so well as to go into place without a machine shop.

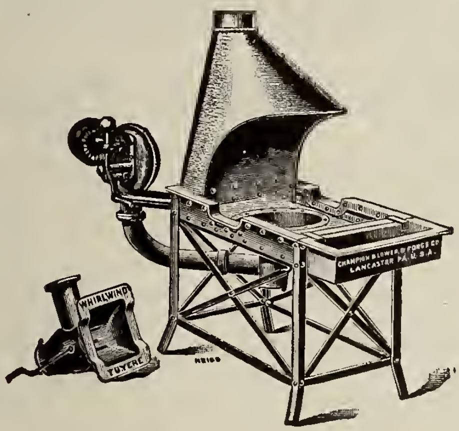
Visit our works and see how all this is accomplished.

MONTREAL LOCOMOTIVE WORKS, LTD.

DOMINION EXPRESS BUILDING, MONTREAL, CANADA

Aikenhead's

No. 408 Contractor's Forge



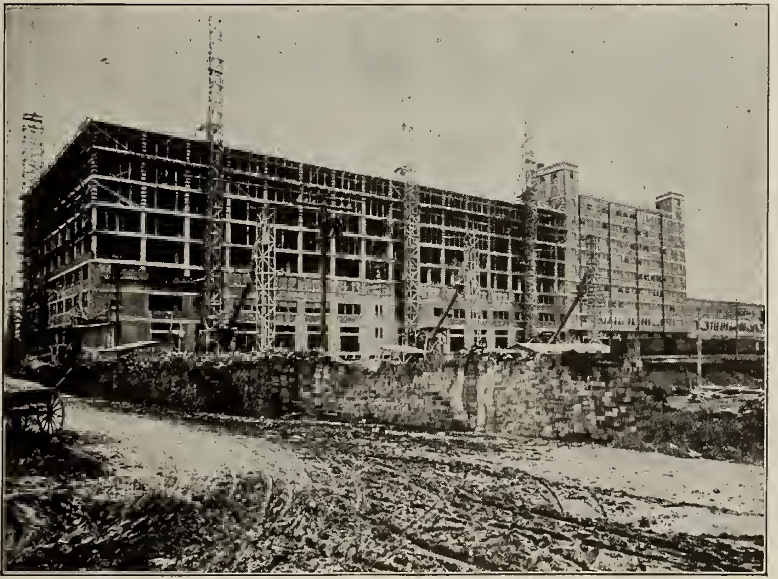
Full Line Blacksmith's Tools

This forge is very strong and durable specially adapted for general blacksmith work. It is equipped with No. 400 Blower, Whirlwind Tuyere Iron, and Half Hood, Hearth 30 x 36 in., Height 30 in., Weight 300 lbs.

Genuine Peter Wright Anvils and Leg Vises.

Aikenhead Hardware Limited, 17 Temperance Street
TORONTO

THE TURNER MUSHROOM SYSTEM



View of Sears-Roebuck Company Building, under construction, Dallas, Texas

REINFORCED CONCRETE FLAT SLAB CONSTRUCTION

(Patented)

The recent decision of the Hon. Chas. A. Willard in the U. S. District Court of Minneapolis in the Drum vs. Turner concrete patent case sets at rest pretended claims of Mr. Turner's imitators.

All infringers are being rigidly prosecuted, as Mr. Turner has in his employ at the present time five of the best known and most able firms of patent attorneys in the United States.

OWNERS, PROTECT YOUR OWN INTERESTS by demanding that your flat slab designers furnish an infringement bond of an amount equal to the cost of your building. Demand a bond for a five-year term and make yourselves safe.

THE MUSHROOM SYSTEM

is the original reinforced concrete flat slab system and is the only legitimate flat slab on the market today.

For designs, estimates and suggestions embodying the best of our long experience, you have only to consult our Engineers, without any obligation on your part.

Make the Concrete construction in your building secure by utilizing the long experience, right design and efficient service behind the Mushroom System.

C. A. P. TURNER
M. Can. Soc. C. E.

Consulting and Contracting Engineer
Main Office: 6th Floor, Walker-Burton Bldg., Minneapolis, Minn.

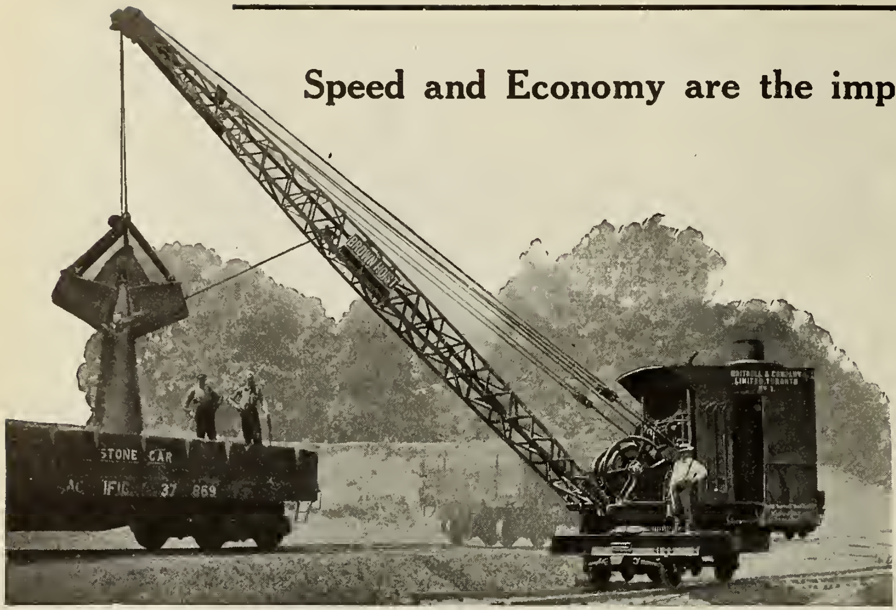
Canadian Offices

Winnipeg, Canada
1005 Lindsay Building

Calgary, Alta.
312 Leeson & Linehan Building

Vancouver, B.C.
424 Vancouver Block

Speed and Economy are the important factors of your costs



when handling sand, gravel, crushed stone, coal, ore, etc., from and to cars, wagons, bins, and stock piles.

BROWNHOIST
Locomotive Cranes

will handle your material speedily and economically.

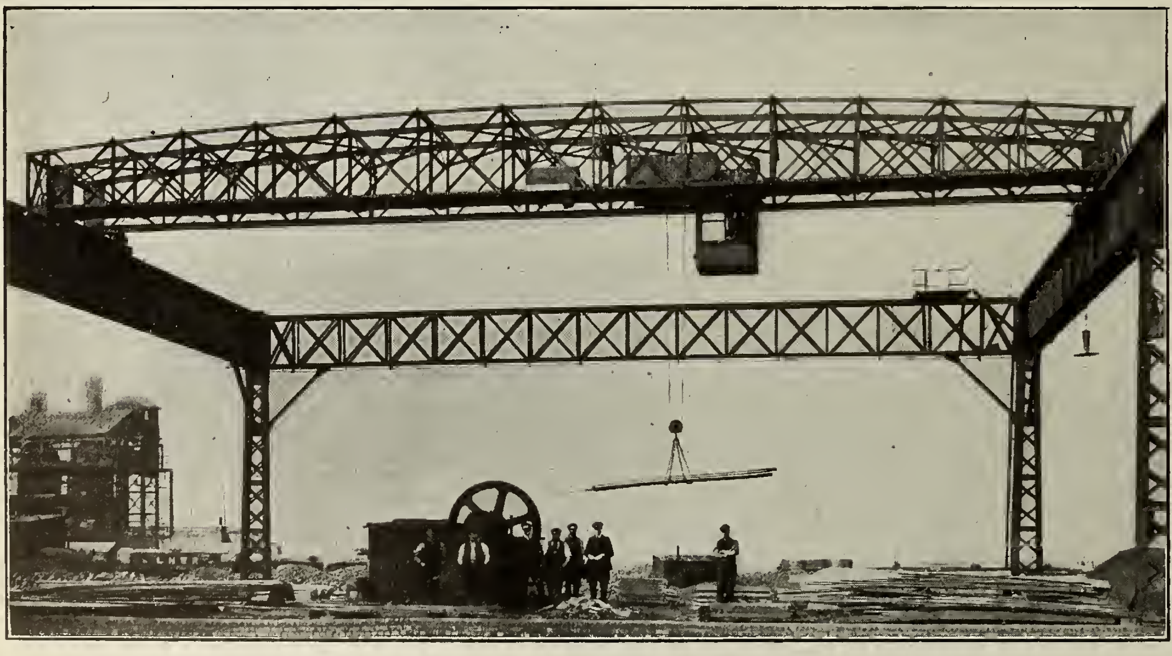
10-ton Brownhoist Locomotive Crane used by Britnell & Co., Ltd., Toronto, Canada.

Speed The Brownhoist Locomotive Crane handles 60 to 120 tons per hour of these loose materials, with one or two men besides the operator. It replaces 20 to 30 men on this kind of work.

Economy The cost of the crane is $8 to $9 per 10 hr. day, which includes operating, interest on the investment and depreciation. By replacing 25 men, it saves $30 to $40 per day. And the crane can be worked both day and night.

Send for Catalog K which shows how and where these cranes are used

THE BROWN HOISTING MACHINERY CO., CLEVELAND, O.
Canadian Office, 145 St. James Street, MONTREAL



Royce
Electrical
Cranes
Capstans
Telfers
Winches

Include
Royce
Crane Type
Motors,
Controllers,
Over
Hoisting
Safeguard.

Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

YOUR ENQUIRIES ARE SOLICITED FOR

CRANES TELFERS CAPSTANS WINCHES

ROYCE, LTD., Trafford Park, Manchester, England

One Municipality Saved $92,000

By advertising their tenders in the " Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before ; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office :

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

The "Contract Record" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates ?

When you are in the market for material or labor send us your advertisement. We will save you money.

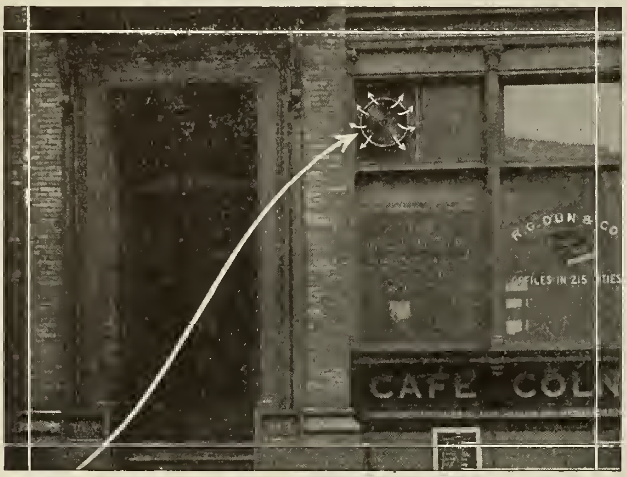
ESTABLISHED 1886

Contract Record and Engineering Review

220 King Street West, Toronto

"BUFFALO" FANS

KEEP THE AIR MOVING



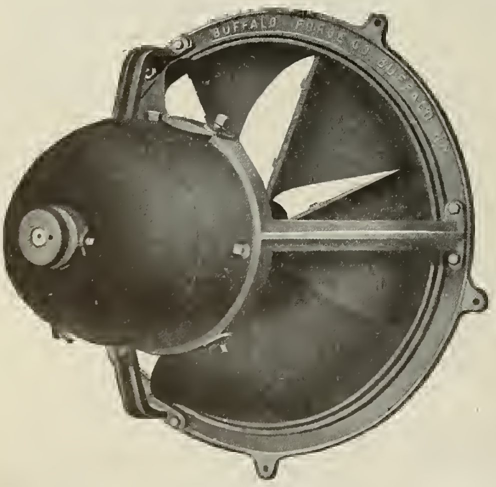
A "BUFFALO" DISK FAN

will remove that foul, overheated air and replace it with fresh invigorating air direct from the outside.

We offer a simple and inexpensive means of moving large volumes of air at low pressures or against small resistance. No other device is so effective or economical for cooling rooms in which heat is generated such as laundries, engine and boiler rooms, veneer rooms, etc.

Bulletin No. 262-12 illustrates and describes these fans in detail. Let us send you a copy.

CANADIAN BUFFALO FORGE CO.
Limited
BERLIN
ST. JOHN MONTREAL TORONTO WINNIPEG VANCOUVER



"BUFFALO" ELECTRIC PROPELLER FAN

Warehouse Space To Let

5 Floors of This New Building, For Office and Warehouse Use.

Adelaide St. W., Toronto

This is the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

Centrally located at Adelaide and Charlotte Streets.
Light on four sides
Passenger and freight elevator
Vaults
Low insurance
One block from four car lines
Floor area, 6,300 sq. feet, each floor.

For further particulars ask

R. A. Donald
Union Bank Building - Toronto

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

Head Office - - New Glasgow, N. S.

STAND FIRM!

A grave responsibility rests on the big men of every community. They are the leaders of public opinion. And public opinion makes or breaks a business, a city or a country.

Just now with the air filled with rumors, the nervous grow more nervous and the responsibility of leadership grows heavier on those who are capable of bearing it.

Canada's soundness needs no argument with you. Canada's ability to weather this storm is not a matter of guesses or hopes—but one of facts and figures.

No one can exaggerate the awfulness of the present war, but the harm that admittedly can come through undue pessimism can be fended off only by men who with reason and faith and good seamanship hold the tiller of common sense and courage firm against the present storm.

STAND FIRM!

Northern Electric Company
LIMITED

MONTREAL
HALIFAX
TORONTO

WINNIPEG
REGINA
CALGARY

EDMONTON
VANCOUVER
VICTORIA

WIRE ROPE

WIRE ROPE

MANUFACTURED BY

THE DOMINION WIRE ROPE CO., LTD., MONTREAL

"Industrial Works"

Locomotive-Coaling and Wrecking

CRANES

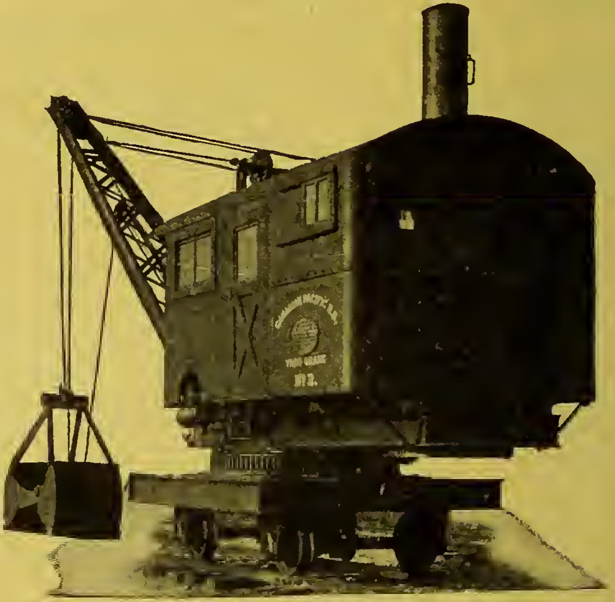
In capacities from

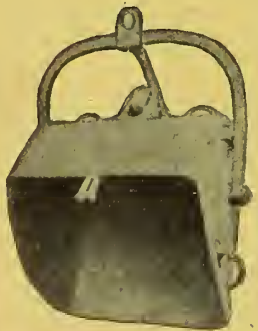
5 to 150 tons

For use about Railroads, Manufacturing Plants, Coaling Stations, Quarries, etc.

BUCKETS

For Every Purpose





We furnish all styles of buckets promptly. Coal Tubs, Ore Buckets, Clamshell and Orange Peel Buckets, Concrete Buckets, Stone Skips, etc. in all sizes.

We will gladly furnish full details upon request

We supply CONTRACTORS' EQUIPMENT of all descriptions

F. H. HOPKINS & CO., HEAD OFFICE **MONTREAL**

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

Vol. 28 Toronto, September 9, 1914 No. 36

Contract Record and Engineering Review

ESTABLISHED 1886

BELLISS & MORCOM, LTD.

Engines and Air Compressors

Over 150 Sets Installed in Canada

Laurie & Lamb
Sole Agents for Canada for

R. HORNSBY & SONS
Gas and Oil Engines

PATERSON ENGINEERING CO.
Municipal Filtration Plants

J. P. HALL & SONS
Boiler Feed Pumps.

AVELING & PORTER
Steam Road Rollers

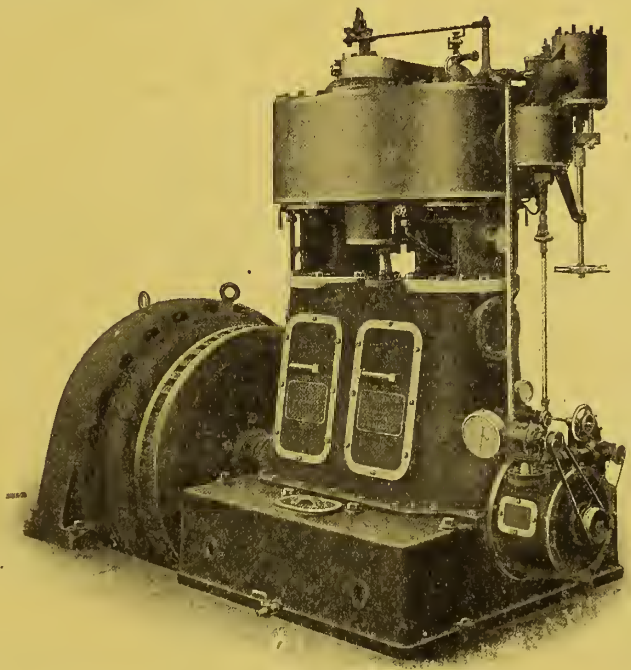
JONES & ATTWOOD
Sewage Installations

LEYLAND ENGINEERING CO.
Motor Trucks and Fire Appliances

W. SMITH & SONS
Road Sweepers

S. H. JOHNSON & CO.
Filter Presses
"FRAM" Electric Wagons

HEENAN & FROUDE
Refuse Destructors



570 B.H.P. Belliss engine at 375 r.p.m.

LAURIE & LAMB

Engineers

212 Board of Trade Bldg. :-: :-: MONTREAL

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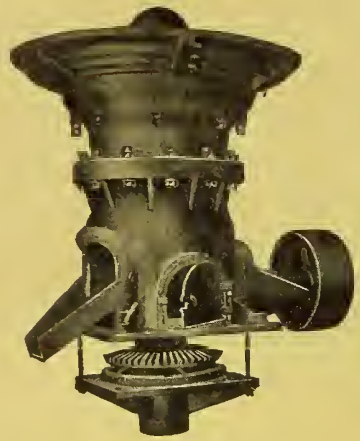


Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

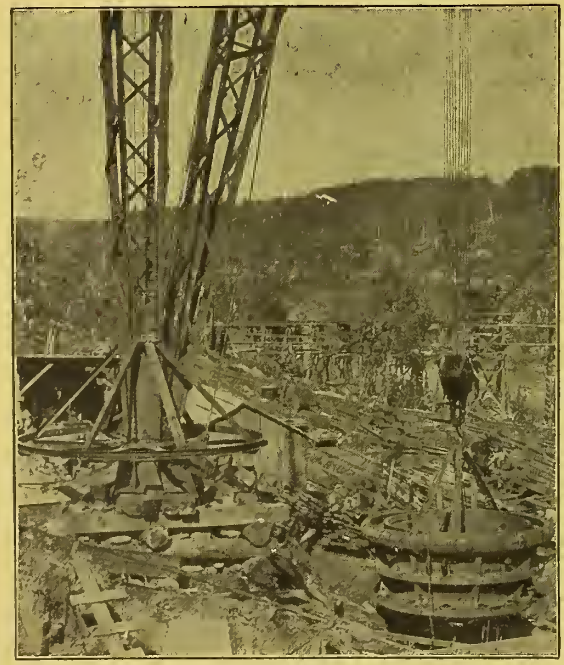
This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson



One man takes a chance, that's gambling; another buys "AMERICAN" Steel Derricks, that's good business, which is nothing but sound common sense.

Every possible stress and strain is covered by the carefully calculated and proportioned construction of these derricks.

An "AMERICAN" Fifty-Ton Steel Guy Derrick

is shown here working on the Hardaway Contracting Company's big hydro-electric power construction at Whitney, N.C. It is lifting a 96,000 pound casting of a Gates crusher. This derrick has a monster 5 sheave block—as tall as a man.

Greatest safety, longest service—You get them both when you buy "AMERICAN" Steel Derricks.

MADE BY

American Hoist & Derrick Company
ST. PAUL, MINN., U. S. A.

SOLD BY

General Supply Co. of Canada, Ltd., Montreal, Ottawa, Toronto. Stuart Machinery Co., Winnipeg, Man.
Vancouver Machinery Depot, Ltd., Vancouver, B.C. Gorman, Clancey & Grindley, Edmonton and Calgary, Alta.

For Permanent Lines :

CAST IRON PIPE

for

Water and Gas Supply, Fire Protection, Road Culverts, etc.

30" Intake, floated to position before lowering

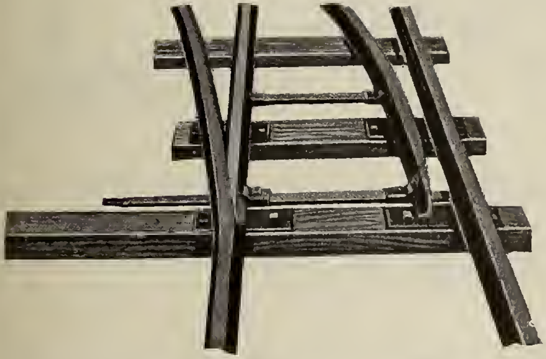
United States Cast Iron Pipe & Foundry Co.

General Offices :—BURLINGTON, NEW JERSEY

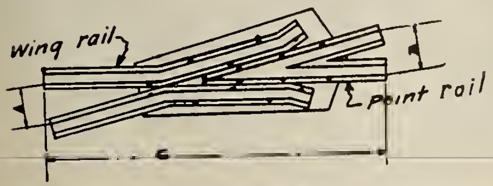
Sales Offices :—Philadelphia, Chicago, Buffalo, Portland, (Ore.,) New York, Chattanooga, Pittsburgh, St. Louis, San Francisco

A Practical Switch

Standard Ground Throw



Switch Points, Connecting Rods and Slide Plates



Rivetted Plate Frog

The Bechtel Policy

Simplicity and Strength

has been closely adhered to in the manufacture of the Switch illustrated. This switch is constructed for spiking to wooden ties, and consists of one throw, one frog, one pair points (spliced rails 4 ft. long) and two connecting rods with clips and four slide plates. If desired, the throws can be put out of use temporarily by turning up several inches of the extending parts of the first connecting rod, so that the points can be moved with the foot.

Full data and prices on request

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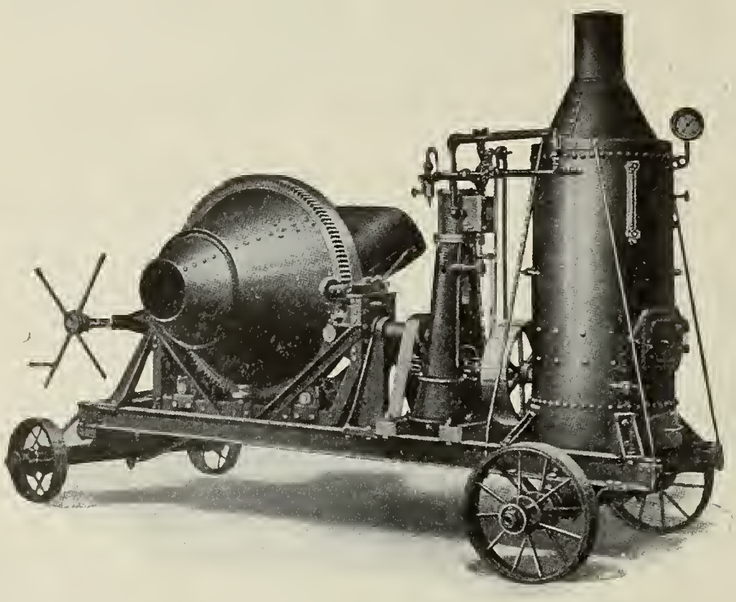

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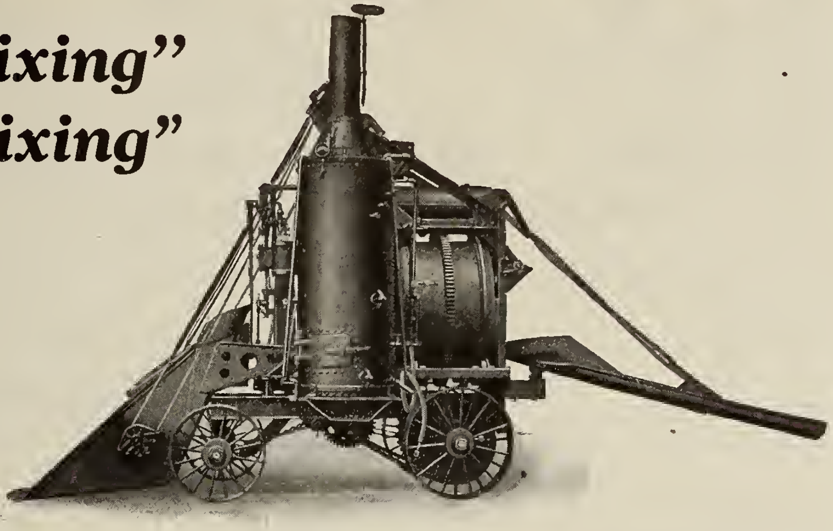

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M-C Rail-Track Paver

Points too valuable to overlook. Compare them with those on other machines. That's all we ask.

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Two speeds ahead, one speed reverse;
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Drives like a traction engine, up hill or down;
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"Luxfer" means Daylight

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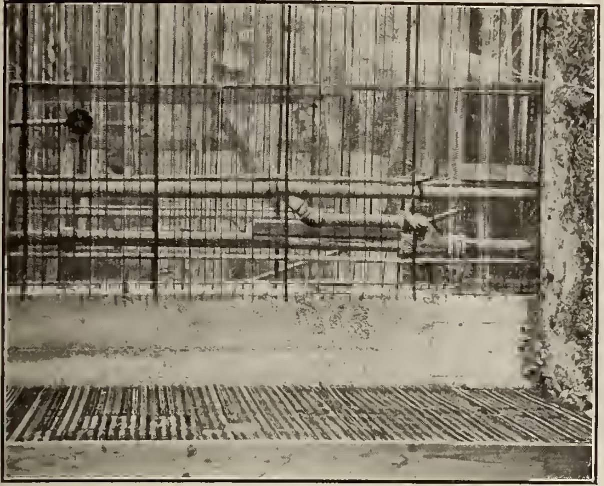

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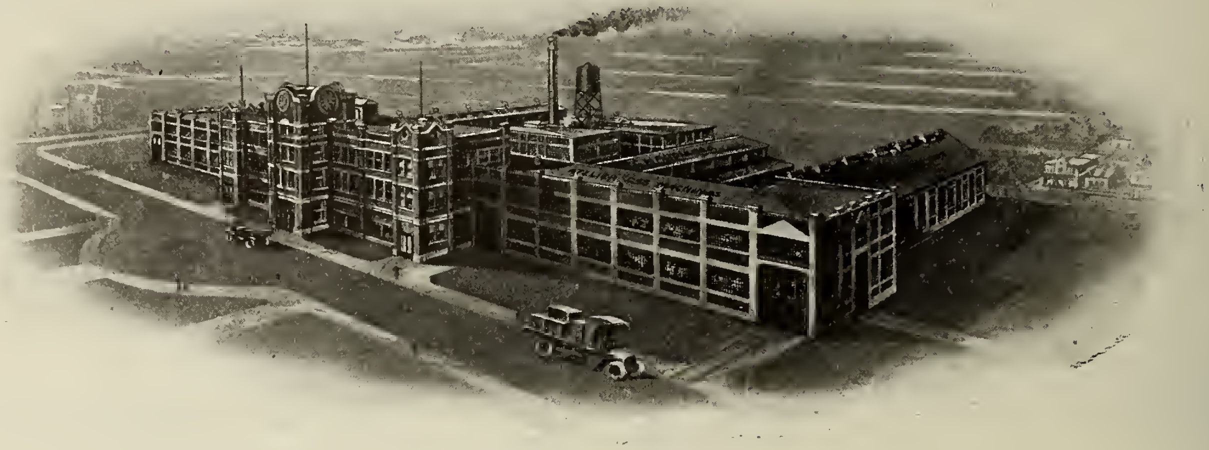

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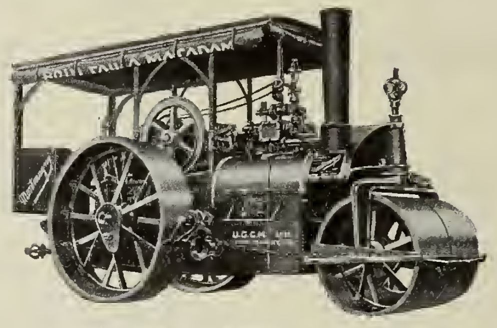
The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



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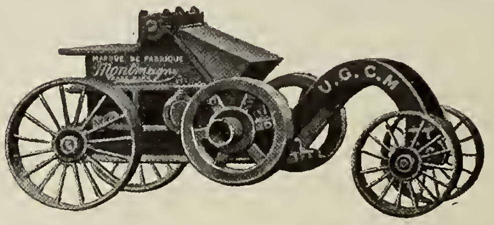
Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"



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Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

"Montmagny" Portable Steel Bin.

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The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

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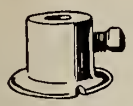


Fig. 1

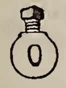


Fig. 2

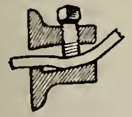


Fig. 3

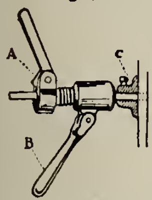


Fig. 4

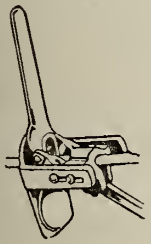
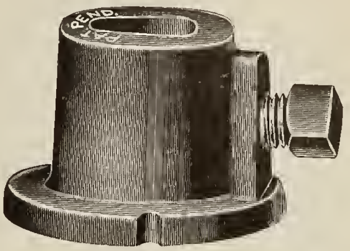


Fig. 5

Use UNIVERSAL CLAMPS

to convert any round rod into a bolt



Long bolts—removable bolts—bolts extending through timber and poured concrete—these are best for form work.

The Universal Form Clamp converts round rods of any size into threaded bolts with removable heads and adjustable nuts.

Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section. showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after another clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screw is tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

One Clamp for walls, columns and soffits This clamp is literally *universal* in application. With these low cost cast iron clamps and various lengths of steel rods, forms may be held rigidly in place during the entire process of building.

Write for circulars and prices. We'll send a sample clamp for 10c. to pay postage and packing.

Universal Form Clamp Co.

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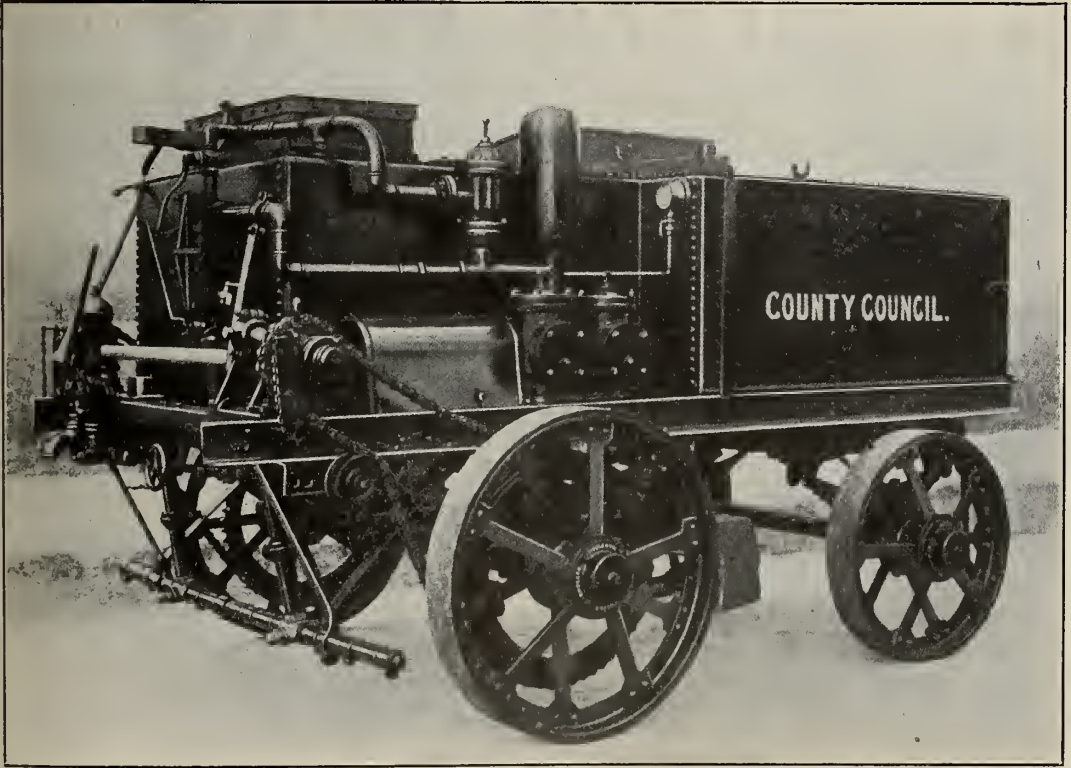

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(penetration assured.) They are capable of DOUBLE the output of all others machines.

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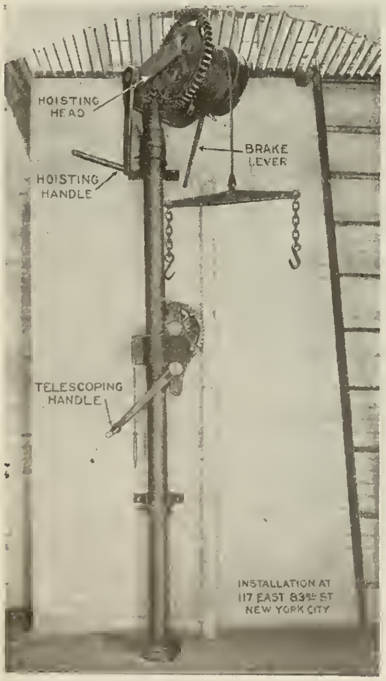
G & G TELESCOPIC HOIST (PATENTED)



Compact—easy to erect. Takes up no room in basement.

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.

1.—It is telescopic—no part showing above sidewalk when not in use.

2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.

3.—Simple in construction and absolutely rigid when erected.

4.—It is made of strongest and most durable material.

5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.

6.—A powerful ratchet device is provided with both handles above mentioned.

7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.

Gillis & Geoghegan

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New York

Hoisting head revolves. Can is deposited on Sidewalk without lifting.

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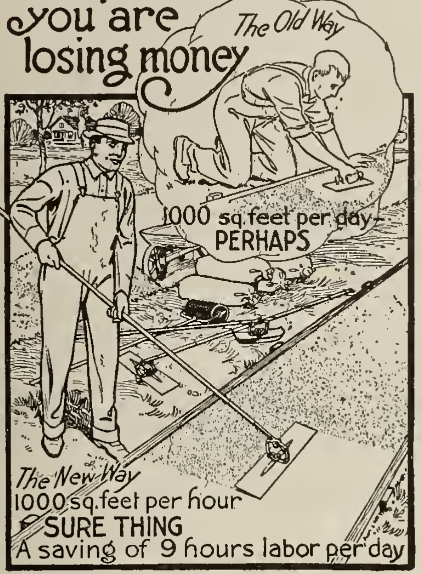
If you are not using
"ABRAM" TOOLS
It is plain to be seen you are losing money



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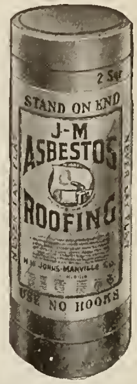
If you knew you would have to spend $180.00 every few years to repair your roof to preserve it and make the guarantee good, would you buy it? Painting **is repairing,** and it will cost $180 at the very lowest price to paint every 100 squares of roofing twice.



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is a little higher-priced at the beginning than ordinary roofings—but its **first cost** is the **last cost.** It never needs paint, gravel or other protection. So it saves money in the long run.

Made of Asbestos (rock) and Trinidad Lake Asphalt—both minerals. Literally a flexible **stone** roofing. Gives excellent fire protection. Not affected by heat, cold, salt air or acid fumes.

J-M Roofing Cleats, packed in each roll, make joints absolutely water-tight and do away with unsightly black cement. In ready-to-lay and built-up form. Suitable for all types of buildings.

Users of rubber type roofing can get J-M quality in J-M Regal Roofing.

Write our nearest branch for specimen of Asbestos Rock and Catalog.

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Macadam Roads

must be built of a

Tough Stone

that will cement

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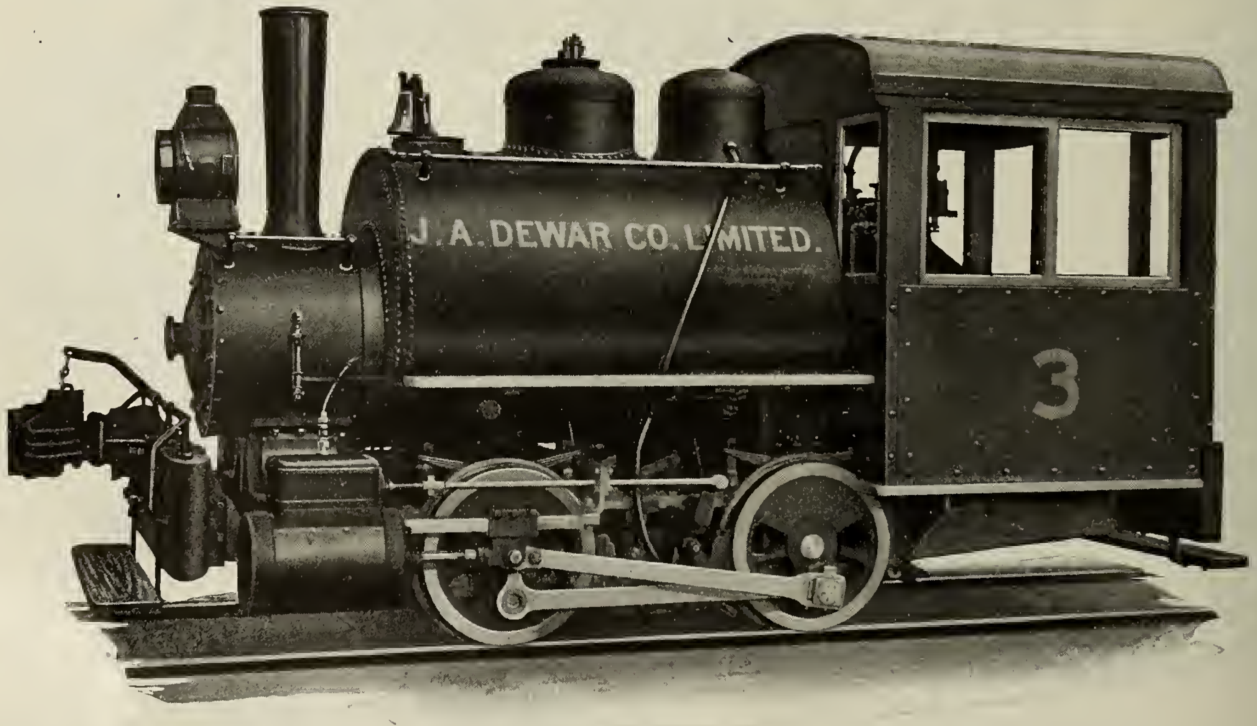
CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

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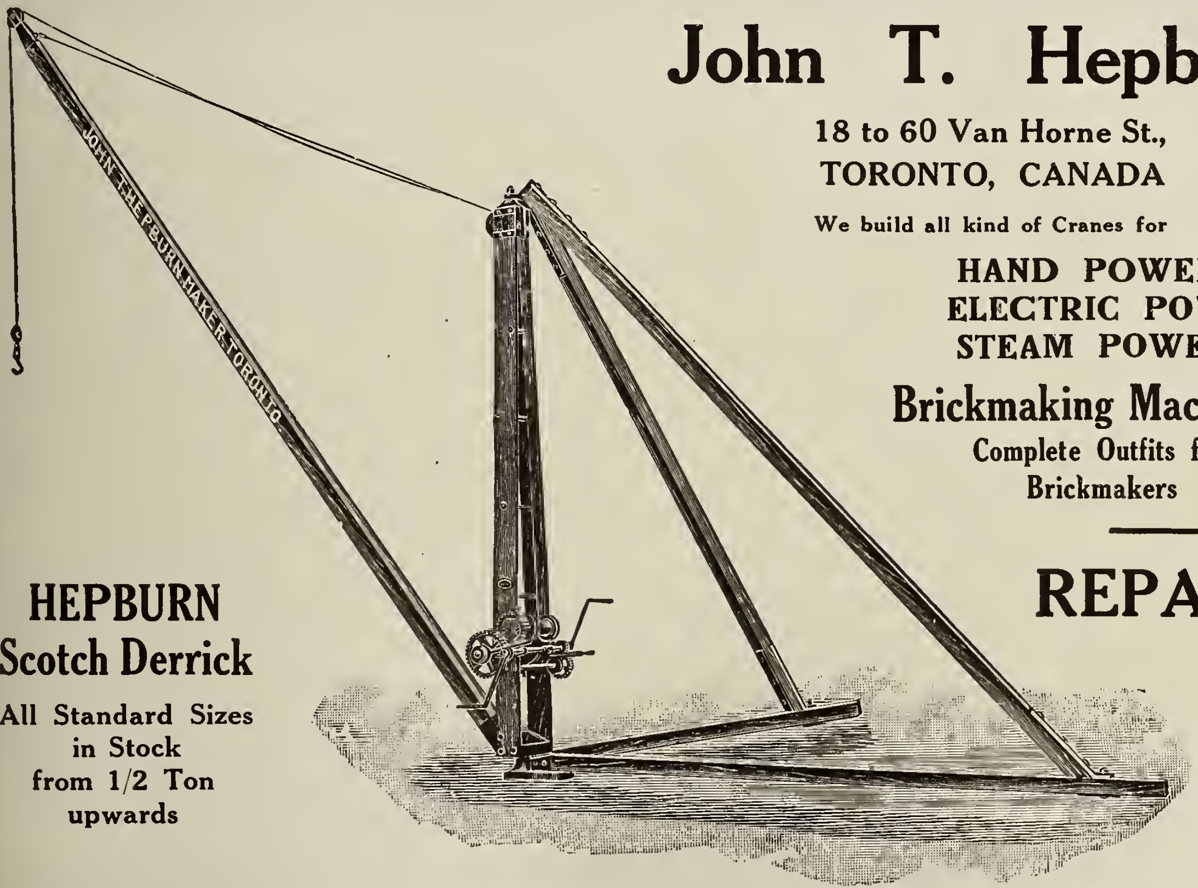
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We build all kind of Cranes for

HAND POWER
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All Standard Sizes
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Canadian Bag Company, Montreal.
Architects, Ross, McDonald, Montreal.
Gen. Con., C. E. Deakin, Montreal.
Roofer, Sibley & Huot, Montreal.

A Barrett Specification Roof was put on this building because—

THE architect knew all about the different types of roofing and further knew that the Canadian Bag Company were mighty particular people.

They had a big plant and they wanted it covered with a roofing that would give *long service at a low cost.*

Under such conditions the architect knew there was only one choice, namely: a Barrett Specification Roof, because it gives longer service at a lower **unit cost** (the cost per square foot per year of service) than any other roofing he could specify.

This building is now covered with a Barrett Specification Roof and it will probably last twenty years or more with **no maintenance cost.** Many such roofs have lasted thirty years.

Every permanent building, whether large or small, should carry a Barrett Specification Roof because that means the most economical roof, and one that will be free from leaks and maintenance.

Ask any first-class architect regarding this proposition and he will verify all of the foregoing statements.

Copy of The Barrett Specification with roofing diagrams mailed free on request.

Special Note

We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding.

If any abbreviated form is desired, however, the following is suggested:

ROOFING Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15, 1911, using the materials specified and subject to the inspection requirement.

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Our advertisers represent the most progressive manufacturers and dealers. Make your purchases of them. Give your business to the man who is enterprising enough to spend money and time to get in touch with you.

Napanee Hoisting Engines

Recognized by Contractors and Engineers as the standard hoisting engines, because they have been built to fill all the requirements of Contracting and Engineering work.

Napanee Rock Drills

Have the simplest valve arrangement of any drill on the market.

Can be successfully operated by any workman or laborer.

MADE BY

The Napanee Ironworks, Limited

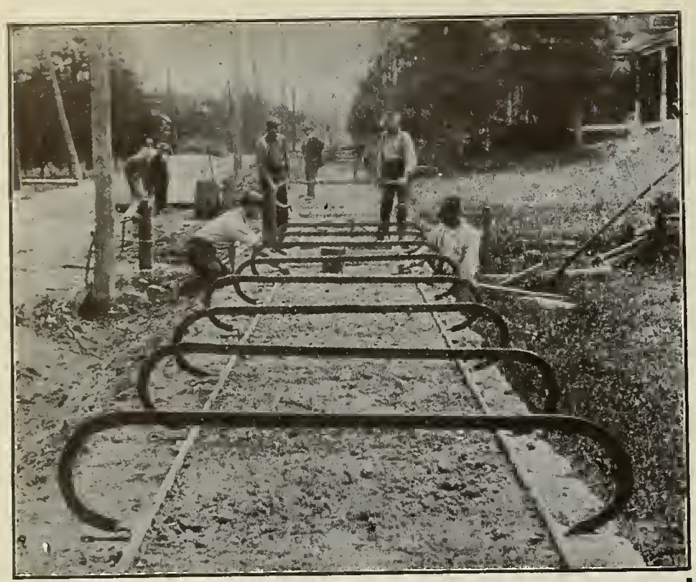
NAPANEE, ONTARIO

SALES AGENTS

Lecky & Collis, Limited

NAPANEE, ONTARIO

43 Scott Street, TORONTO 49 Beaver Hall Hill, MONTREAL



Malone "Complete Finish" Steel Concrete Sidewalk Forms

Eliminate lumber costs, reduce labor expense. Continuous and complete operation in furnishing, removing and replacing. Adaptable to any surface conditions. Adjustable to any width. Indestructible and independent of any weather conditions.

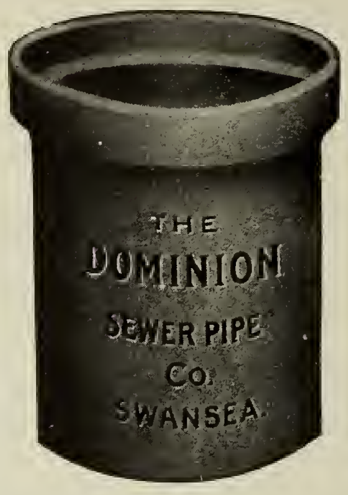
THE MALONE STEEL CONCRETE FORM CO.

Canadian Representative:
A. E. Patton, 77 Somerville Ave., Montreal
Write for prices and particulars.

SWANSEA

Salt Glazed and Vitrified

SEWER PIPES



True to Size.
Impervious to Water.

Sizes manufactured and always in stock 4 in. to 24 in.

Ask for Price List and Discounts.

also

Chimney Tops
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Inverts

Telephone (Toronto Connection)
Park 1809

The Dominion Sewer Pipe Co.

(The Independent Co.) Limited
SWANSEA (near Toronto)

The Thew Steam Shovel Will Save You Time, Trouble and Money

Type O Thew on Road Grading

The use of a Thew Automatic Steam Shovel will effect an immense saving in labor.

The output is limited only by the facilities provided to cart it away.

The Type O Thew shown in the cut loaded 1,965 cu. yds. in 7 ten-hour days.

Another Type O Thew in a 6 ft. cut averaged 578 cu. yds. during the month of April.

Another Type O Thew in a gravel pit loaded 5,182 cu. yds. in 7½ ten-hour days—an average of 76 cu. yds. per hour.

Another Type O in a 15-inch cut averaged 314 lineal feet, amounting to 292 cu. yds. per 9-hour day for 23 days.

Another Type O in a 10-inch cut excavated 1,788 lineal feet in 6 ten-hour days—amounting to 1,455 cu. yds.—an average of 242 cu. yds. per 10-hour day.

USE A THEW—IT PAYS.

Write for Catalogue and Full Information.

The Thew Automatic Shovel Company, - Lorain, Ohio

Town and City Sewers

In our salt glazed vitrified sewer pipe we offer the highest type of sewer material. Pipe of our manufacture have been used in practically every city in Canada. Highly glazed and perfectly vitrified.

If you are contemplating sewer construction we can quote you some attractive prices. We also make all classes of fire clay goods.

Prompt shipment on all orders.

Standard Clay Products Limited

THREE SEWER PIPE FACTORIES : **St. Johns, P. Q., and New Glasgow, N. S.**

ALSO FIRE CLAY FACTORY AT ST. JOHNS, P. Q.

Mimico Sewer Pipe

VITRIFIED AND SALT-GLAZED

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Service

ROUND PIPE AND SQUARE DEALINGS

The Ontario Sewer Pipe Company, Limited

MIMICO, - ONT.

Crushed
Stone ....Cu. Yds
For Concrete or Road Construction

Portland
Cement ....Bbls.

Trap Rock—Granite ....Cu. Yds.
G.T.R., C.P.R. and Team Delivery

Let us quote on your requirements.

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Address...
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Delivery..
Required at

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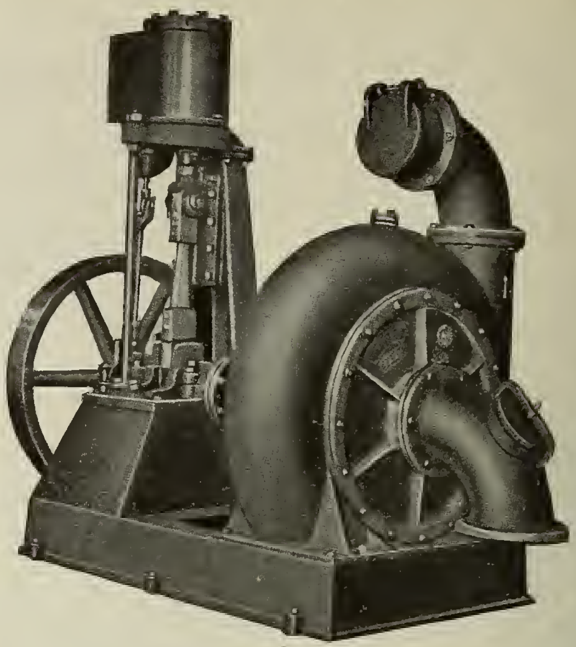

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Complete Hydraulic Dredging Machinery
Centrifugal and Turbine Pumps for Every Service

MORRIS MACHINE WORKS - Baldwinsville, N.Y.
Canadian Sales Agents—
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BLACK and GALVANIZED

RUST-RESISTNG SHEETS

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UNITED STATES STEEL PRODUCTS COMPANY

NEW YORK, U.S.A. Branch Offices, WINNIPEG AND VANCOUVER

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TORONTO

Sewers and Culverts

properly built of properly made

Reinforced Concrete Pipe

LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

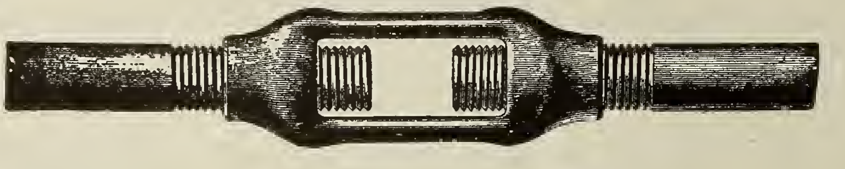
Catalogue and prices on application

Dominion Concrete Company Ltd.

Kemptville, Ontario

Canadian Billings & Spencer, Limited

B TRADE MARK



B TRADE MARK

Full line of steel specialties for
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Welland, Ontario

Electric Generating Plants

DIRECT RUNNING AUTOMATIC OR STORAGE BATTERY SETS

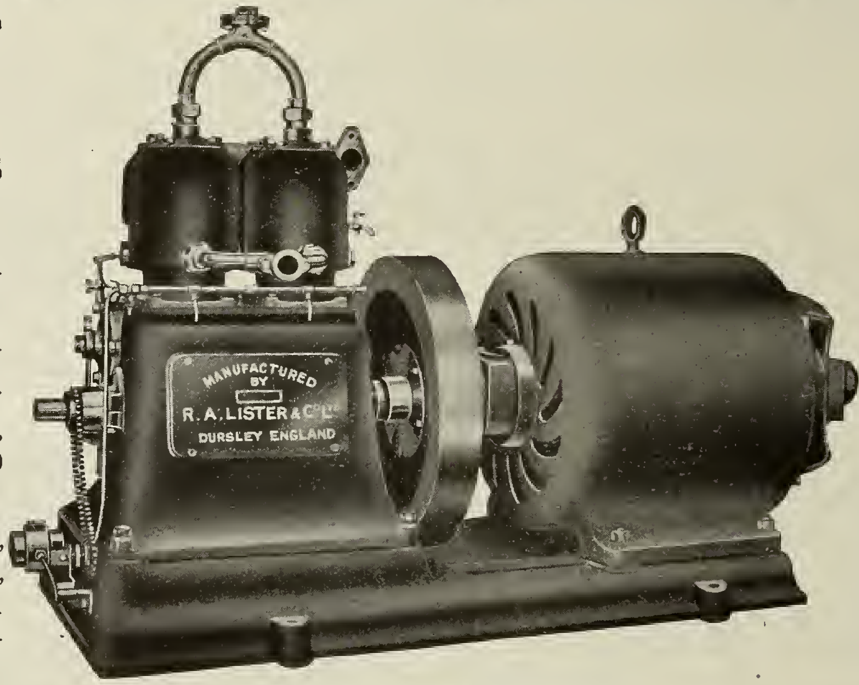
Description

Direct Coupled or Belt Driven.

One, Two or Four Cylinder Engines.

Stocked in 50-60, 110-115 and 220 volts.

.5, .75, 1.00, 1.6, 2.0, 2.6, 3.5, 4.0, 5.0, 6.0, 10.0 and 12.0 kilowatts capacities.



6 K.W. Generating Set

Hundreds in Use For

Small Towns.
Moving Pictures.
Street Lighting.
Mining Plants.
Contractors' Plants
Hotels.
Country Houses
Factories.
Etc., Etc.

Running on Gasoline, Natural Gas, Town gas and Kerosene.

Send for Catalogue "E" and Prices.

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Winnipeg 58-60 Stewart St., TORONTO St. John, N. B.

Sash Weights and Cast Washers

Manufactured by

Fittings, Limited, Oshawa

Montreal Winnipeg Vancouver

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

KAHN SYSTEM

OF REINFORCED CONCRETE

Steel Sash

Hyrib

Rib Bars

Rib Metal

KAHN SYSTEM
Reinforced Concrete

Concrete Finishes

Water-proofing Pastes

STEEL FLORETYLE
FOR LONG SPAN CONSTRUCTION

Trussed Concrete Steel Co.
of Canada Limited
Head Offices and Works: Walkerville, Ont.
Branches Everywhere

Splendid 41 ft. 60,000 Capacity Newbody Flat Cars Especially Designed for Logging Purposes

Largest Rebuilders of Railroad and Contractors' Equipment in America. Operate two extensive plants near Chicago. Have filled large orders of equipment for Canadian Contractors. Write for specifications and quotations on anything you need.

Central Locomotive & Car Works
410 Fisher Bldg. Dept. S.
Chicago, Ill.

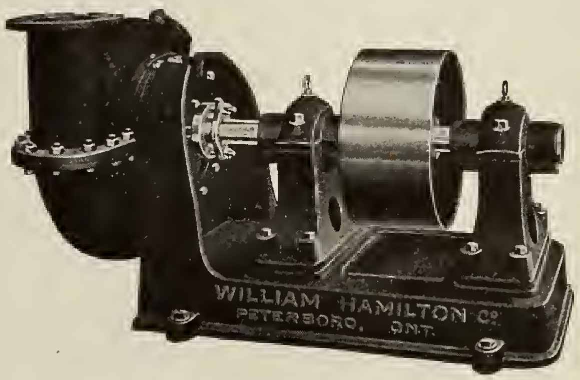
$45. GARROW

Contractors Acetylene Flare Light

The great feature of this new light is strength and simplicity. The light is constructed of steel assembled by the Oxyacetylene Welding Process and consists of three parts. It is made to stand the roughest handling by unskilled labor without injury. A distinct advantage of the Garrow Light is its use in confined places, such as tunnels, mines, etc., without any danger from escaping gas. The Garrow Light entirely eliminates the danger of gas being generated faster than the burner will consume it, by means of the patented by-pass chamber which conducts excess gas to the patented double burner and ignites it at the main flame.

$45.00 F. O. B. Sudbury

The
Sudbury Construction & Machinery Co., Ltd.
Sudbury, Ont.



Contractors' Pumps

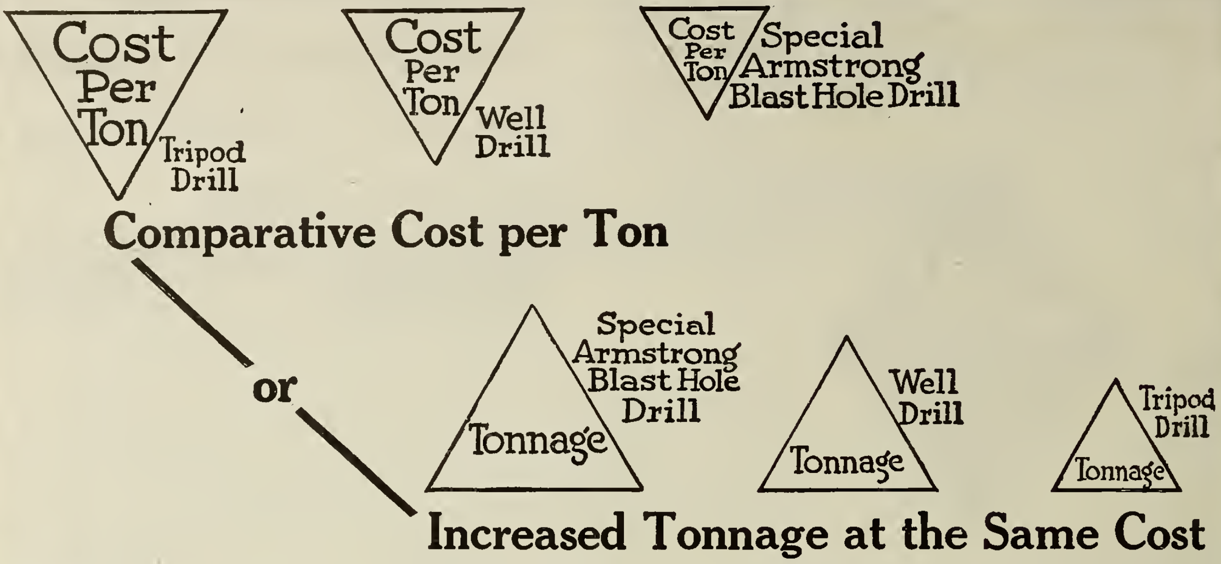
These pumps have been specially designed for contractors' use. They are made for belt, direct engine or motor drive.

They have special features not found in any other pumps, notably the horizontally split shell and the wide spacing between pulley and bearings.

They are built in all sizes from 2-in. to 14-in. discharge.

Ask for pump bulletin.

William Hamilton Company
Peterborough, Ontario

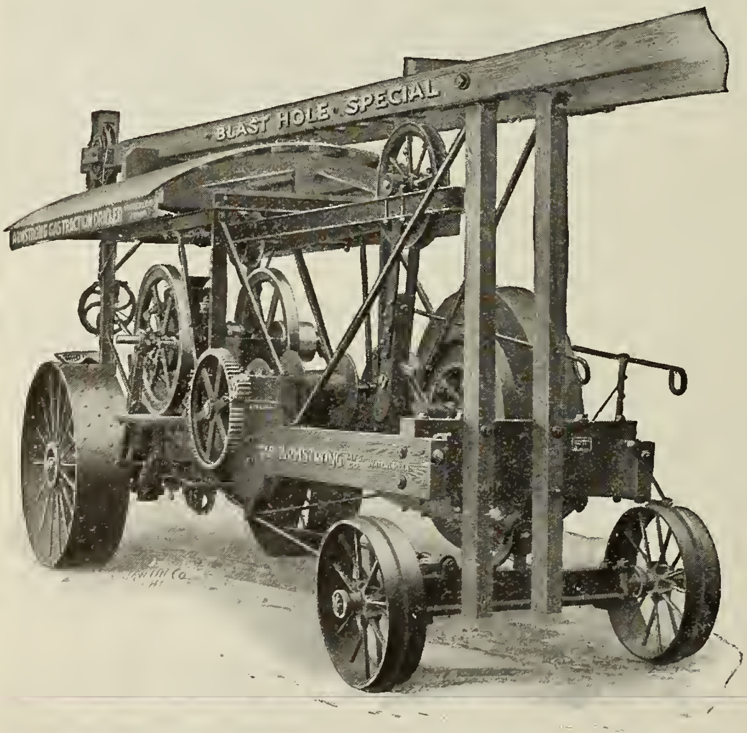


ISN'T it more economical to shoot out the *whole face* in one blast rather than take the rock out in benches? It saves a big share of the cost of powder per ton of rock—it eliminates several settings of track and movement of machines—it minimizes the delay of your crew and shovel—it reduces the possibility of accidents.

And isn't it more economical to drill the necessary good sized deep holes for face shooting with a drill that releases a quick, heavy, smashing blow at every contact, and at a speed that cannot be obtained by the use of well drills?

It is the efficiency and design of the Special Armstrong Blast Hole Drill that make possible the wide difference in results in comparison with any other method.

Armstrong
BLAST HOLE DRILLS
BUILT FOR SERVICE SINCE 1867



Proof from an Armstrong Owner

Armstrong Mfg. Co., Waterloo, Iowa.

We are glad to advise that the drilling machine recently purchased from your company, according to proposal submitted under date of February 20th, wherein you guarantee to drill a minimum footage of 65 feet per day, has fulfilled the requirements, and we are glad to fulfill our part of the proposal.

A. & C. STONE COMPANY
By JOHN MURNANE.

Mr. Murnane made a test with the Armstrong Blast Hole Drill with the following result:

Drilling time—10 days.
Footage drilled—722½ feet.
Number of moves—40 (11 hr. 59 min. moving time).
Delays caused by rain and moving, changing bit, batteries, etc.—19 hr. 22 min.
Delay caused by rain alone—6 hr. 7 min.
Delay in two 200 yd. moves turning machine around—4 hr. 40 min.
Footage drilled per day—72¼ ft.
Footage drilled per hour—9.1 ft. net (7.2 counting delays).

We guarantee the Armstrong Special Blast Hole Drill to drill MORE hole at less cost in a given time than any cable drill on the market, and we will write this in every sale contract we make.

Write for Bulletin S.

ARMSTRONG MFG. CO.
Established 1867
Waterloo, Iowa, U. S. A.

Eastern and Export Office
17 Battery Place
New York City

Western Branch
3rd and San Pedro Streets
Los Angeles, Cal.

Canadian Branch: Drinkle Block No 2, Saskatoon, Sask.

Hull Iron & Steel Foundries, Limited

HULL, - QUEBEC

Manufacturers of

"Adamantine," Chrome and Manganese Steel Castings

(Annealed and Unannealed)

TRADE MARK

IF IT'S CASTINGS WRITE TO US. ADAMANTINE MANGANESE STEEL

Machine - Moulded Gears up to 16 feet. Grey Iron, Semi-Steel, Brass, Bronze and Aluminum Castings.

Cement Mill Machinery

Our Specialty

- Tube Mill Feeders
- Griffin Mill Roll Heads
- Ball Mill Plates for Krupp Mills
- Kominuter Plates for Smidths Mills
- Steel Balls for Kominuters
- McCaslin Conveyer Wheels with "Coplan" Self-Lubricating Bushings
- Lining Plates for Bonnot Tube Mills
- Parts for Bonnot Pulverizers
- Screw Conveyer Bearings
- Eccentric Hubs, Crusher Heads and Concave Strips for Gates Crushers
- T. M. Revolving Feeders (new style) for Gates Tube Mills

Patterns for all these lines kept on hand.

We solicit your patronage and prompt attention will be given to tenders on above work.

Montreal Office, New Birks Bldg. Phone up-town 4069

The best known and most extensively used damp-proofing is

R. I. W. No. 232 Paint

It eliminates the necessity of Furring and Lathing

Can be plastered over

Send for 1914 Red Book

"R. I. W." DAMP RESISTING PAINT CO.

Office: 202 Mail Building, Toronto (TOCH BROS. Est. 1848.) Factory: Oakville, Ont.

DISTRIBUTORS—Black Building Supply Co., Limited, Toronto Western Paint Co. Winnipeg
Dartnell, Limited, Montreal Canadian Equipment & Supply Co., Limited, Calgary and Edmonton

Write nearest distributor for full information

Wells & Gray, Limited

Engineers and Contractors

List of work completed or in progress since January 1st, 1914:

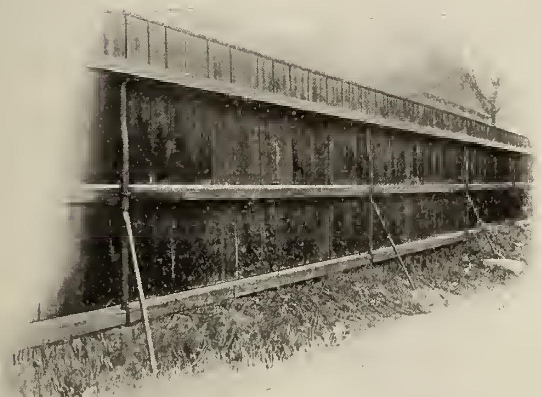
Roden Bros. Ltd., Toronto, Three-Storey Mill Construction Factory
Hydro-Electric Power Commission, Stratford, Transformer House
Hydro-Electric Power Commission, Niagara Falls, Transformer House
Hydro-Electric Power Commission, Walkerville, Transformer House
Canadian Seamless Wire Co., Toronto, Mill Construction Factory
Canadian Pacific R. R. North Toronto, Yonge Street Subway
Lake Simcoe Ice Co., Toronto, Industrial Trestle
City of Windsor, Concrete Brick and Reinforced Incinerator Building
Town of Walkerville, Fire Proof School Building
Town of Sandwich, Fire Proof School Building
McGregor Banwell Fence Co., Ford, Ont., Fire Proof Office Building
Ford Motor Co., London, Ont., Reinforced Concrete Service Building
Ford Motor Co., Ford, Ont., Reinforced Concrete Factory and Office Building
Cadwell Sand & Gravel Co., Windsor, Ont., Reinforced Concrete Barns
Merchants Bank of Canada, Ford, Ont., Branch Bank
Remington Arms Co., Windsor, Ont., Extension to Factory

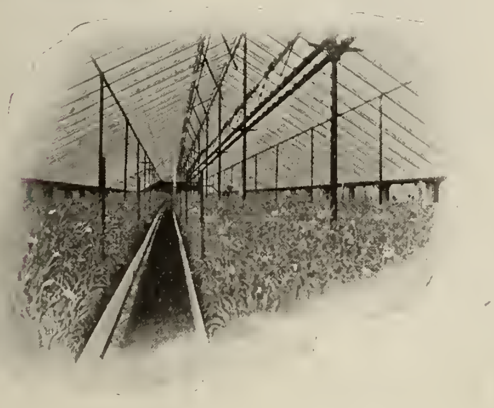
Wells & Gray, Limited

Branch Office:
Royal Bank Building
WINDSOR, Ont.

Head Office:
Confederation Life Building
TORONTO, Ont.

Everlasting Kyanized Spruce





Every class of wood construction is subject to decaying influences and, if built of untreated wood, must be renewed periodically.

Economy of first cost and of maintenance cost demand that you investigate Kyanized Spruce.

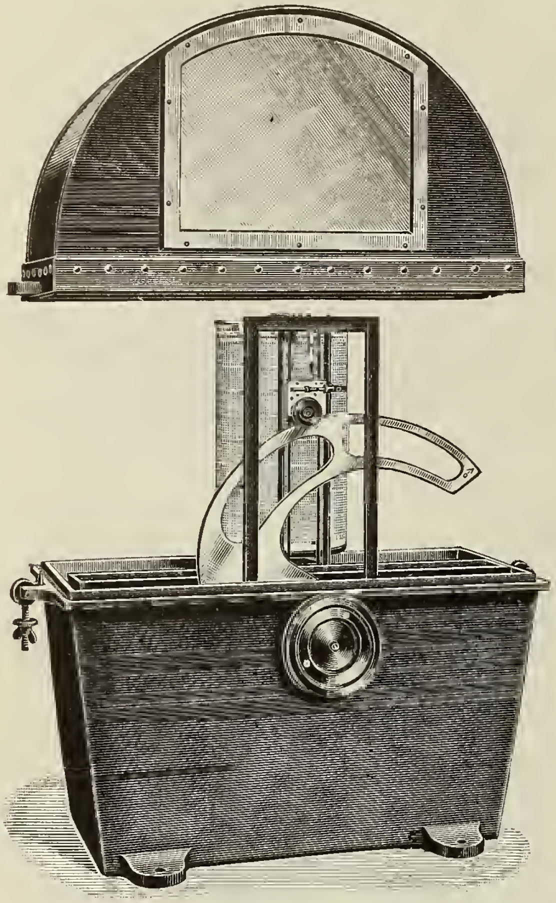
Spruce is a wood noted for its combined strength and lightness. Kyanized Spruce is so treated by a special process that it is practically immune to decay from any cause.

Kyanized Spruce used 65 years ago is sound today.

Write for our Catalogue, "Structural Wood and Its Preservation from Decay", and get prices.

Berlin Mills Company

Portland, Maine



CAM RECORDERS

For recording the quantity of water or sewage flowing over a sill or through a notch. A strong, reliable instrument, not liable to derangement, and of the best manufacture and finish. Easily installed because no elaborate levelling is required.

Send for Book No. 6

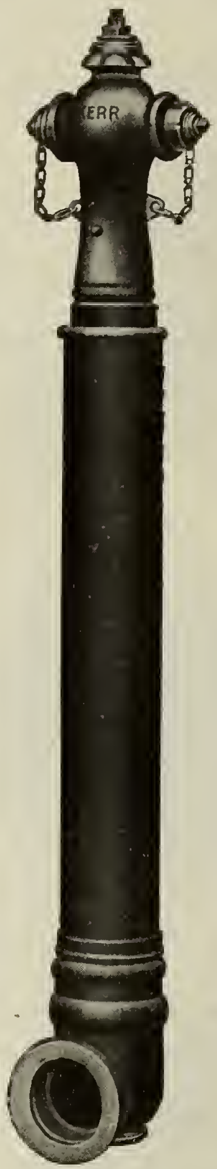
which contains fullest information about all classes of Water Level Apparatus.

GENT & CO., LTD.
Leicester, England

KERR

Hydrants and Gate Valves

are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of waterway, and are strong, compact and modern in design and construction.



Standard Compression Hydrant

Send us your Specifications and Enquiries.

Prompt attention given.

6" Hubbed

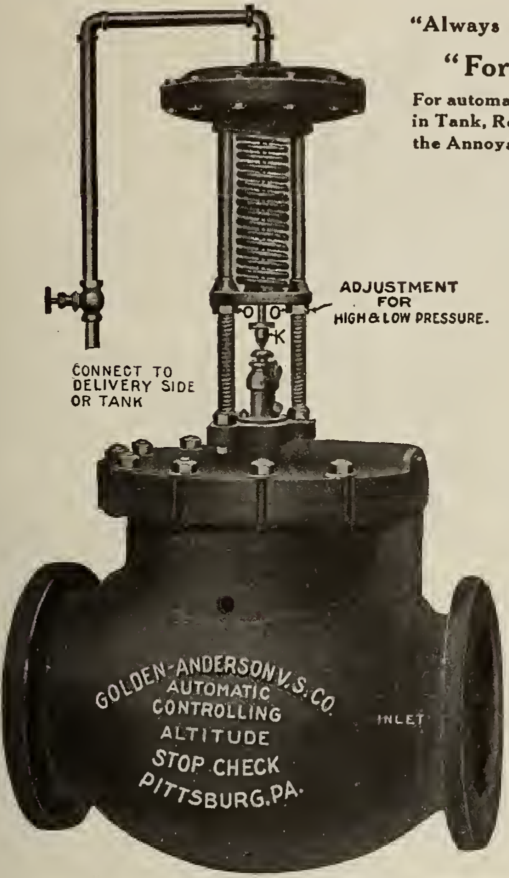
THE KERR ENGINE CO.
LIMITED
WALKERVILLE, ONT.

The Golden-Anderson Pat. Cushioned Controlling Altitude Valves

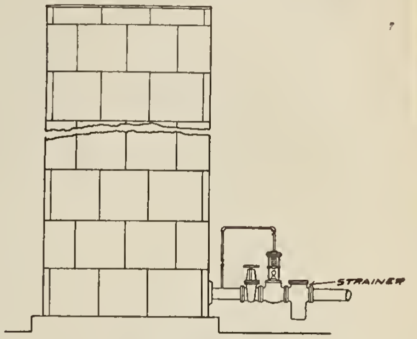
"Always Cushioned in Opening and Closing"

"For High and Low Pressure"

For automatically maintaining Uniform Stage of Water in Tank, Reservoir or Standpipes. Doing Away with the Annoyance of Float Fixtures inside or outside.



Altitude Valves can be arranged with "Stop Check feature" to automatically close should Break occur in the Mains, thus preventing the flow of water from the tank, standpipe or reservoir.

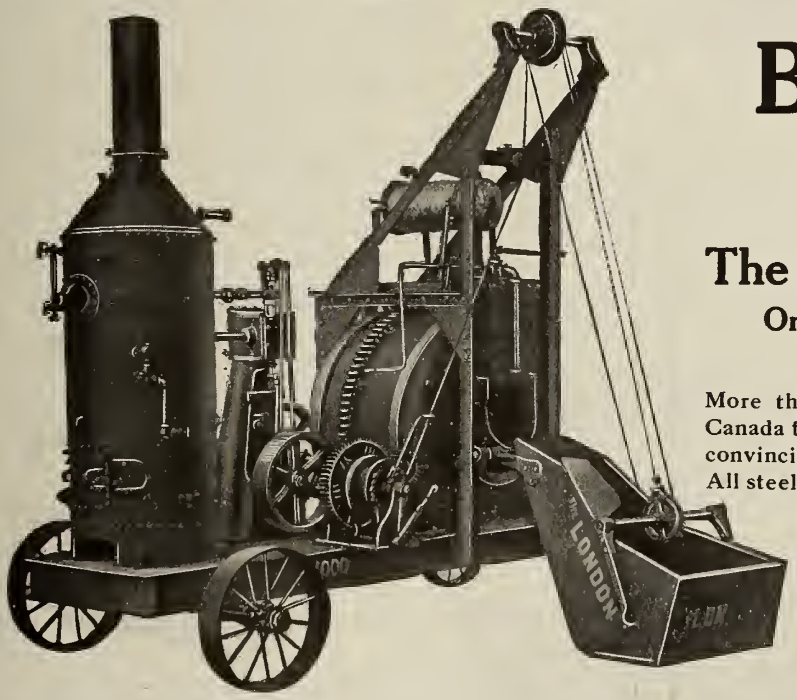


Automatic Cushioned Water Pressure Regulating Valves, up to 24"

Golden-Anderson Float Valves

(Angle or Straight Way), up to 24"

Golden-Anderson Valve Specialty Co., 1247 Fulton Bldg. Pittsburgh, Pa.



Built Like a Battleship

The London Concrete Mixer

Once a specialty—now a question of our output capacity

More than 1200 London mixers are in use throughout Canada today. Also many in foreign countries. This convincing evidence of the superiority of the London All steel construction with few working parts. London Concrete Mixers are built in twenty-three ifferent sizes and can be fitted with any equipment. We manufacture a complete line of concrete machinery and cement working tools.

We are the Largest Manufacturers of Concrete Machinery in Canada

THE LONDON CONCRETE MACHINERY CO., LTD.

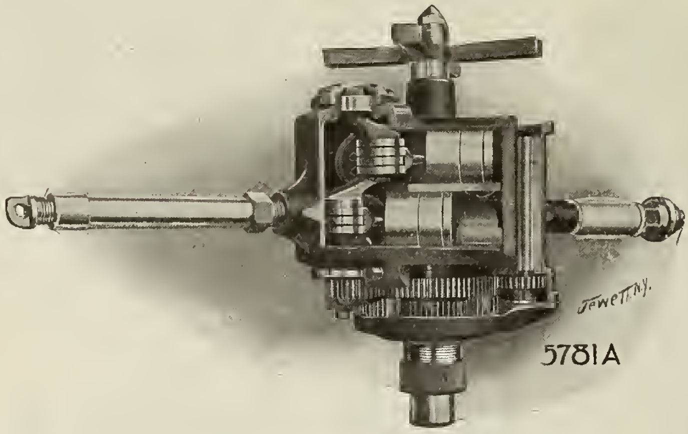
Head Office and Factory: Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES:
WINNIPEG—565 Portage Ave.—W. H. Rosevear, Manager.
CALGARY—622 9th Ave West—P. D McLaren, Manager.
TORONTO—112 York Street—G. B. Oland, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

AGENCIES
Vancouver—B. C. Equipment Co.
Montreal, P. Q.—Foss & Hill Machinery Co.
Port Arthur and Fort William, Ont.—Northern Agency & Equipment Co.
Quebec, Que.—Masson Limitee.
Ottawa—The General Supply Co., of Canada.

For Drilling, Tapping
and Reaming Metals;
For Driving Studs, Flue
Rolling and for Wood Boring

USE "LITTLE DAVID"
PNEUMATIC TOOLS



"Little David" Drill partly in section.

They are simple, sturdy, light and convenient.

"Little David" Drills embody improvements that mean real savings both in power and repair costs.

Power bills are reduced because energy is applied to the work in a most direct manner; valves are of the rotary type, quick opening, with sharp economical cut-off and smooth, silent action; ports are short, direct and amply large; there are no unnecessary motions, no unnecessary parts; every part is carefully designed and carefully made to eliminate friction and vibration as far as possible and to insure smooth free running tools.

Cranks are fitted with specially adapted ball bearings. Spindles move on ball bearings with special ball thrust bearings. The crank ends of connecting rods are equipped with roller bearings. Connecting rods are made of a single forged piece, all alike and interchangeable. Every part is made as simple and strong as possible. There are one-third fewer parts than in any other four cylinder drills of equal capacity.

You'll find "LITTLE DAVID" Drills the most satisfactory tools you have ever used.

CANADIAN INGERSOLL-RAND CO., LIMITED

COMMERCIAL UNION BUILDING, MONTREAL, CAN. - WORKS: SHERBROOKE, QUE.

Sydney, Montreal, Toronto, Cobalt, South Porcupine, Winnipeg, Lethbridge, Nelson, Vancouver.

HOSE FACTS

When buying hose, remember that you are paying for **service**—not for just so much "rubber with a hole in it."

Breakdowns and interrupted work due to faulty hose must be reckoned far beyond first hose cost. Men's time and wages go on regardless.

Choose the hose made for its particular purpose. Trusting to luck is poor economy. Remember that every hose requirement is met in the Goodyear line. Special inner tubing for this purpose. Special covering for that. Every need anticipated, studied and met—from steam and water hose to pneumatic tool hose.

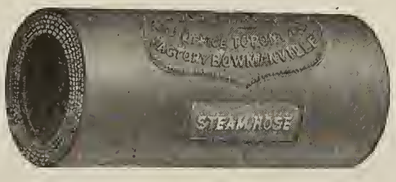
It costs nothing to consult Goodyear experts and have them tell you just what particular Goodyear hose meets your exact requirements—and why. Buying this way is the **service** way—the economical way.

Read of the advantages of Goodyear Hose designed and made for use in the building field.

Goodyear Steam Hose

This hose has a steam, heat, and oil-resisting tube. This protects it against the conditions that soon play havoc with ordinary hose.

GOODYEAR
TORONTO
Service Hose



The tube cannot "cook" or harden. Even when tested for 1,446 hours at 100 lbs. steam pressure, with oil injected, this hose showed no impairment from the oil.

Goodyear Steam Hose can be had wire wound when desired. This prolongs its life under rough usage.

Goodyear Pneumatic Tool Hose

This hose also has an oil-resisting lining that protects it from the oil carried in under air compression—an important feature in building operations. Air passage is always free.

Made wire wound if desired.

Other Goodyear Products

Remember that Goodyear also make Belting, Packing and Valves for every purpose. Each designed and perfected for its particular service.

No Goodyear product is ever made to meet a price. They are made in Canada at the Bowmanville, Ontario, factory, and governed by the same quality standards that have won leadership for Goodyear Automobile Tires.

Put your equipment problems up to Goodyear experts. This means money saved—service gained.

The Goodyear Tire and Rubber Co. of Canada, Limited
Head Office—TORONTO, ONT. Factory—BOWMANVILLE, ONT.
Branches at—Victoria, Vancouver, Edmonton, Calgary, Regina, Winnipeg, Hamilton, Ottawa, Montreal, St. John, N.B.

When You Specify Cement

You are Always Safe in Adding

"Waterproofed with Medusa Waterproofing"

The rapid growth of Western Canada has resulted in an immense amount of building there. The high price of lumber and other building materials has opened an almost unlimited field for cement construction.

The worst fault of cement, its tendency to absorb moisture, can be easily, cheaply and permanently corrected by the use of

MEDUSA **The original dry white powder Waterproofing**

Only a small quantity is necessary under ordinary conditions, and a slightly larger quantity for reservoirs and other structures subject to heavy water pressure.

Medusa was used with perfect success on the great Fort Garry Hotel in Winnipeg, and many other important contracts.

It is supplied in 40 lb. sacks in any quantity. Special prices on ton lots or over.

FORT GARRY HOTEL, WINNIPEG

Erected under Direction of Ross & Macdonald, Arch.
Contractors: Geo. A. Fuller Co., Ltd.
30,000 lbs. Medusa Waterproofing used in this building

Stinson-Reeb Builders' Supply Co., Limited

9th Floor, Read Bldg., 45 St. Alexander St., MONTREAL, QUE.

Architectural Bronze and Iron

Illustrating ornamental iron and steel folding storm sash, Summer Cafe, Chateau Frontenac, Quebec, facing Dufferin Terrace. Work includes eleven large panels of ninety folding steel doors, twelve small panels and twenty-five columns.

Contract signed April 20th 1914, ornamental iron furnished and erected complete on June 1st.

ESTEY BROS., COMPANY

Canadian Office and Works, MONTREAL **Head Office, NEW YORK**

Branch Offices—N. J. Dinnen & Co., Winnipeg, Calgary, Vancouver **Scott, Hammond & Pratt, Toronto**

ESTABLISHED 1886

Contract Record and Engineering Review

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THOMAS S. YOUNG, General Manager.
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The Panacea for Pessimism—Work

Sound Doctrine of the British Press

In considering the destructive element in the situation brought about by the present calamitous war, and in making rightful provision for the dependants of those engaged in active service, we must not overlook our responsibilities from the constructive viewpoint, having regard to the maintenance of such activity at home as will preserve our business equilibrium and enable us to rise to the opportunities which will undoubtedly present themselves when the word goes forth to cease fire.

It is gratifying to note that the measure of responsibility likely to be recognized by governing authorities in the old country finds active support and encouragement in the representative technical journals of Great Britain. We have all come to a full appreciation of the ties which bind Canada to the mother country and so it is interesting to follow the trend of opinion in the constructional world there, as voiced by our contemporaries.

Of the many articles dealing with the war and its effect upon British trade that we have read in English journals, we are particularly impressed with the observations of "The Engineer," "The Sanitary Record and Municipal Engineering," and "The British Clayworker," which are reproduced in whole or in part elsewhere in this issue. Generally, we believe that these articles will make interesting and suggestive reading, but the manner in which certain principles are laid down is deserving of special emphasis as embodying the law and the prophets. We commend the following paragraphs, which embrace sound economics and good common sense:

> "Profits decline with the pay sheet and decline in a ratio that is altogether disproportionately great as compared with the decline in the pay sheet. . . . . To enable the masters to retain their men as far as possible, the men, by working at lower rates for the time being, must help to spread the wages over a larger section of the working community."
>
> "The policy of inter-purchasing between manufacturers in this country must be developed."
>
> "Our manufacturers, with all the fortitude in their power, must face the difficulties of a temporarily collapsed trade, strong in the conviction that when the war is over their position will be far stronger than it has ever been."
>
> "Owners of brick works . . . . can turn the present occasion to some good account by overhauling their kilns, machinery, plant and works generally, in order to see in what manner their business can be conducted on better lines. Indeed, even under normal business conditions, a pause in the year's work might well be available for this purpose."
>
> "Upon the engineers of municipal authorities the responsibility will chiefly lie of formulating schemes of improvement. Sufficiency of work can be found if every local authority will rise to its task."

The only panacea for pessimism is work. So long as we attend to business and remain a nation of optimists and workers we need have little apprehension regarding the internal stability of the Empire. It is more than likely that we shall be called upon to make sacrifices, but our commercial integrity and business stability can be maintained through all sacrifice if a sane, conservative policy of confidence and co-operation be put into effect. After the present enemies of the Empire are vanquished on the field of battle it will remain for us to make the victory complete in the industrial field. Ultimately it will be shown that "commerce, not arms, is the real ruler of the world."

In the present great crisis of the world's history each one of us has a well-defined duty. Let us meet it to-day and await the dawn of opportunity on the morrow.

Our Contemporaries on the War Crisis

Suggestive and Significant Utterances of the British Technical Press—Editorial Observations Characterized by a Sane Confidence and Appreciation of Individual Duty—The Part of Municipal Authorities Outlined

The War and the British Engineer

"The Engineer" (London, Eng.)

THE colossal struggle which has been suddenly thrust upon Europe has, naturally enough, dislocated every phase of life. Politics, as we usually understand them, finance, food, travel, trade and industry, all for the moment are dependent on the evolution of the vast catastrophe which Britain, France, Russia, Belgium, Servia, Montenegro, Austria, and Germany now have to face, and in which half a dozen other countries are becoming involved.

Among the industries of this country which will necessarily be seriously affected is, without question, engineering, that industry on which the country relies alike for its machines of war and of peace, from a battleship to a barbed wire entanglement on the one hand, and from a pumping station to a plough-share on the other. We have not to deal with the rights and wrongs of the war in this journal. We have not to argue whether or not war was inevitable, or whether it is preferable to have it now or later on. We have not to deal with the excitement and horrors which already are on us, or to harp on the blood which has been and will be shed, of the glory and the misery of the field of battle. The war is here, an actual fact, and whatever the outcome may be, we have to face it and carry it through. There are four cardinal elements that make for success or failure, leaving out of the question the righteousness of the cause. These are the resources of the country concerned, the statesmen who control the policy, the officers and men engaged, and the material used. We, as we hope is the case with everybody in the country, have full confidence in the quality of all four of these essentials. Never was British engineering at so high a pitch of perfection as it is to-day. Never have our Navy and Army been so thoroughly and efficiently equipped with everything that engineering brains and skill could produce for their requirements. Our splendid firms have done everything that human power could do to ensure our success at war, and we await in patience and with confidence the results of our labours now that our materials are to be put to the most severe practical test that the world has ever seen.

We have, therefore, as manufacturers of war material, discharged our duty to our country. Now comes the question, what are we going to do for ourselves? By that we mean for our masters and our men. Our war material firms, no doubt, will be working night and day, and a considerable number of firms which do not habitually cater for this trade will take it up. It is reasonable to suppose, too, that the war will produce a sufficiency of orders in the way of certain railway, electrical, constructional, pumping, and many other types of plant which are necessary accessories to war material. War, in itself, is an enormous producer of engineering orders, and in a war so vast as this it is impossible to estimate even approximately the impetus which it will give to many of our firms which least expect any pecuniary benefit from it. But in Great Britain we have some 1,200 engineering works, large and small, to keep going, and there is no doubt that the war in itself and the purely home orders will not suffice to fill half these firms with work. What is to happen to the less fortunate works and to the hands they employ during the period when no further foreign business can be obtained, a large percentage of the existing orders cancelled, and payments for work done withheld on account of the dislocation of finance? That is the great problem which we as engineers have to face and solve. "Do not discharge your hands," say the Government and the lay journals to the employer of labour. That is obviously a right-minded doctrine to preach. It would be sound, too, were it feasible; but, alas, it is not. We wonder if those people who urge the manufacturer to keep his works running when he has nothing to make realize what the loss entailed by him would mean. A works employing a thousand men has an approximate pay sheet of £100,000 a year. Assuming that our engineering firms are willing to "make work"—that is to say, to manufacture goods without orders which there would be a reasonable chance of selling after the war—there remains the difficulty of material. We venture to hope that this difficulty will prove by no means as great as is thought by some. Coal we have in abundance, and iron and steel and other metals in certain quantities. Then again, owing to the efficiency of our Navy, it is reasonable to suppose that many of the markets from which we purchase our materials will be kept more or less open to us. But prices will in many cases be high, and it is not when such is the case that manufacturers are encouraged to run up stocks, for to be profitable and at the same time to cover the risks of delays in sale, all machinery made for stock must have every advantage in the way of cheap labour and material. But something of the sort must be done, and the trade unions, by lowering wages for the time being, must help the masters by every means in their power to accomplish it. We believe that they will do it. We are in for a period of all-round self-sacrifice, not merely in what we eat and in the manner in which we live, but, above all things, in the way we carry on our work. Those who appeal to the employer to retain his hands when he has nothing for them to do should bear in mind that no employer ever discharges his men if he can avoid doing so. The profits, as every manufacturer knows full well, decline with the pay sheet, and decline in a ratio that is altogether disproportionately great as compared with the decline in the pay sheet. Thus it is that our manufacturers are being asked to do the impossible. Moreover, they are being asked to do precisely what they would give anything to be able to do. To enable the masters to retain their men as far as possible, the men, by working at lower rates for the time being, must help to spread the wages over a larger section of the working community.

It is an ill wind indeed that is now blowing for the majority of our engineering firms—a very ill wind. There is no doubt whatever that some of them will find it difficult to weather the storm if the war is at all protracted. But like the worst of ill winds, it cannot fail to blow some good. That good will be twofold, and we firmly believe that it will far more than outbalance the sacrifices which our firms will have to make in the meantime. One of the effects of this war while it lasts will unquestionably be to cause our engineering firms to purchase much more of their materials in this country than is usually the case. They may have to pay more for them, but that cannot be helped. The makers of such materials must meet them in the matter as far as possible. Too often of late years, while preachnig the doctrine that British plant is the best, we have been inclined to buy our materials in the cheapest market. The policy of inter-purchasing between manufacturers in this country so strongly advocated by the British Engineers' Association must be developed. Now is essentially the time to begin a more patriotic policy than in the past and to strain every effort to find what we want in our own country. The policy of British materials for British firms cannot, of course, be carried out in its entirety, but it can be to a much greater extent than heretofore. The second benefit which the engineering firms of this country should derive from this terrible war is, always assuming that it is carried to a successful issue, that for a long time, at all events, the air will be cleared of that unhealthy and often dishonest class of foreign trade which has been gradually eating its way into the methods of placing engineering contracts abroad. Germany is the country which has introduced and fostered this pernicious system, and we hope that the war will clear the markets of her influence for many years to come. We do not object to foreign competition on open and above-board lines; but the methods of the German manufacturers, due no doubt to the fact that they could not obtain business in a legitimate manner, have been such as to create absolutely unsound conditions which must cease when the credit of that country has been destroyed. That credit, which has been held together by a very fine thread of late years, was well on the way to disruption before the war commenced. It has snapped with a bang during the last few days, and every hour between now and the end of hostilities can only render matters worse for Germany. Meanwhile our manufacturers, with all the fortitude in their power, must face the difficulties of a temporarily collapsed trade, strong in the conviction that when the war is over their position will be far stronger than it has ever been.

From Chicago we learn that Cook County, Illinois, has opened the first building of its hospital, which upon completion will have cost $16,000,000.

The War and Local Authorities: Providing for the Aftermath

"The Sanitary Record and Municipal Engineering" (London, Eng.)

LOCAL authorities as big employers of labour are almost without exception undertaking to pay the wives of Reservists and Territorials who have been called up for service the wages their husbands would have received—less the amount received by the husband from the Government—if they had continued in their employ. We wish they could have been generous enough to pay the whole amount of their wages. It would even then have been inadequate recompense for the severance from home and the perils so many of them will have to undergo. It would, moreover, act as an inducement to others to join the auxiliary forces. All the Local Authorities have also undertaken to reinstate those of their servants will have been mobilized, in the positions they previously held. The nation cannot afford to be ungenerous, and we hope this will be stedfastly kept before the stay-at-homes. A great war cannot be carried on without terrible loss of life, frightful suffering to the maimed and wounded, and anguish and destitution to those robbed of the breadwinner. Our own Royal Family, who possess the beautiful instinct of doing the right thing at the right time, have foreseen that the war will leave a sad aftermath, and that the maimed and wounded will require to be provided for and distress to be relieved. Hence the inauguration of a National Relief Fund, towards which the Prince of Wales has appealed for subscriptions. A noble response has been already made, and a sum of not less than one million pounds will be subscribed. But this will not be enough. Scarcely a city, town, or village in the kingdom will be unaffected, and upon Local Authorities lies the urgent necessity of action. Such Authorities may mitigate the results of the dislocation of industry which will inevitably ensue by expediting schemes of public works upon which surplus labour can be utilized. Moreover, they are advised to prepare schemes in advance and where loans are required for such the Board are prepared to facilitate them.

SCHEMES WHICH CAN BE UNDERTAKEN

Upon the Engineers of Municipal Authorities the responsibility will chiefly lie of formulating such schemes. Their task will frequently be a difficult one, for whatever is undertaken should be in the nature of an improvement. The construction of or extension of sewers and sewage disposal works, the levelling of the surfaces of parks and pleasure grounds so as to make additional portions of them suitable for cricket or tennis lawns or bowling greens; the formation of lakes and children's playgrounds in such parks; the construction of new roads, the lowering of hills on roads, or the paving or strengthening of the foundations of existing roads, or the making up of private streets; the straightening of the courses or the covering over of streams running through populous districts; and the erection of cottages for the labouring classes. Any of these may be carried out to the ultimate benefit of any district, and will therefore be productive labour. Other schemes will doubtless suggest themselves to Local Authorities and their Engineers. In the more rural districts the government proposes to erect cottages for laborers and so afford some employment in such districts in co-operation with Rural Authorities and public utility societies. Sufficiency of work can be found if every Local Authority will rise to its task, and none should be found which is so bereft of generosity for the sacrifices made for the nation by its sailors and soldiers as to delay in preparing for the aftermath of the war.

The Manufacturer's Opportunity

"The Clayworker" (Indianapolis)

MANUFACTURERS and investors need not feel the least hesitation about pushing into the abandoned markets wherever they can be found. All the nations engaged in the conflict are of age. Their rulers, even though they may resent the way of the people have been curtailing the powers of royalty, are of ordinary intelligence and know what the effect will be. Those who are engaged in the embroglio have a right to pick up what has been so foolishly thrown aside. Commerce, not arms, is the real ruler of the world; but age-long race hatred, adroitly fostered by cunning rulers and a ruthless aristocracy, has finally developed a cataclysm which will shift the balance of power in Europe and so change it that it will be unrecognizable. Meanwhile, the trade built up with so much labor is destroyed.

Wherever clay products of any sort have had to compete with those made in either of the belligerent countries they virtually have the field to themselves. The course to be pursued is obvious. We may, and do, deplore what seems to all Americans a senseless conflict and a needless destruction of life and property, but this regret need not, and should not, prevent our profiting by the folly of our erstwhile competitors in numerous lines of manufacture.

Clayworkers in War Time

"The British Clayworker" (London, Eng.)

DURING the present regrettable crisis in the fate of the nations of Europe, and whilst the naval and military interests of this country are in the hands of others, British clayworkers can best help the nation by making every possible effort to find their employees enough work to feed them. Distress there must inevitably be, but the worst means of relieving it is undoubtedly charity pure and simple. It is work that should be found, both to save the workers' self-respect, and to keep the wheels of industry running as much as possible. In those cases where, with the best intentions, owners of brickworks have no option but to close down, they can turn the present occasion to some good account by overhauling their kilns, machinery, plant, and works generally, in order to see in what manner their business can be conducted on better lines. Indeed, even under normal business conditions a pause in the year's work might well be advisable for this purpose. Money saved is, we know, money earned, but many brickmakers fear to interrupt the continuity of their work, although by occasionally doing so they might by improvements save in a very short time a great deal more money than they could earn by continuing over the period allotted to stoppage.

The Government, to their great credit be it said, are acting as promptly to prevent distress as they did to prepare the fleet for service. . . . . . The general position is well summed up by the following statesmanlike notice from the First Commissioner of Works: "It appears from various enquiries addressed to the Commissioner of Works that there exists some apprehension lest unemployment should be increased in the building and other trades by suspension during the present crisis of building and engineering operations provided for in the estimates of the Office of Works recently approved by Parliament. It is, therefore, desirable to state publicly at once that it is the intention of the Commissioner of Works to proceed with all services in their charge, to employ as many men as possible to carry out such services, and to develop and expedite their building programme in any way practicable. As the Minister mainly responsible for Government building, the First Commissioner of Works would wish to take this opportunity of expressing his sincere hope that private individuals, companies, firms, and contractors will spare no effort to follow the policy of the Government in this matter, so far as circumstances admit." We are sure that clayworkers, at all events, will do their best to this end.

Ottawa River Water Supply

COMPLETE plans and specifications for the Ottawa River water system have been laid before the Ottawa Board of Control by Messrs. Hazen & Whipple, New York. The mouth of the intake will be 500 feet out in the river. The purification plant, reservoir and other works will be placed at the junction of Scott Street and Parkdale Avenue. A reservoir with a capacity of ten million gallons, and also a smaller one, will be built. The entire works are designed to meet the requirements of the city for an average supply of twenty-five million gallons daily, but the full capacity will be thirty-five million gallons. At the Queen Street pumping station there will be provision for pumping at the rate of eighty million gallons daily, forty-four millions by water power and thirty-six millions by an electric auxiliary plant. The total pumping capacity of the several units at the low lift station will be seventy-five million gallons a day.

Apropos of the subject of waste, Mr. Fuller states that if the present enormous loss of water in Ottawa is stopped, the plant will be adequate for the needs of a city of from 250,000 to 300,000 people.

The purification plant will be similar in its general design to plants in operation at Westmount, Que., Cincinnati, Ohio, Columbus, Ohio, and New Orleans, La. It will consist of large coagulating basins, mechanical filters, and pure water reservoirs.

The plans make provision for doubling the capacity of the plant. The intake pipes will be made double the capacity of the present installation. Space is allowed in the low level station for another unit of thirty-five million gallons. Coagulating basins, filters and reservoir capacity may be added in the future when required.

Provision is made for the adaptation of certain portions of the work to the construction of the Georgian Bay Canal.

The intake crib will be built as a rock-filled timber crib up to low water level, and above that the construction will be boulder concrete. Wooden bar screens will be placed in front of the intake to exclude logs and other large material. The intake pipes will consist of

C.P.R. constructional operations on the Selkirk tunnel.

The C. P. R. Double Track Tunnel Through Mount Macdonald, B. C.

IN our issue of April 8, we described the preliminary steps taken to construct the C. P. R. double track tunnel through Mount Macdonald, one of the peaks of the Selkirk Range, B.C. This will shorten the route by four miles, effect a considerable grade reduction, and enable one of the most costly sections of the system, from an operation point of view, to be abondoned. Since April the force of men has been largely added to, and great progress has been made with the scheme. An enormous amount of excavation was required to obtain the right grade for entering the tunnel at the western portal, while a large amount of filling had to be done near the point where the present line turns off. The excavation was done by means of steam shovels.

As previously explained, the contractors have adopted the system of the "pioneer" bore with a view to facilitating construction. This consists of a separate tunnel driven in a line fifty feet parallel with the course of the main passage through the mountain. The idea is to permit drillers to concentrate their activities at several different points at once instead of confining their efforts to one place, as with the usual method. Drifts are projected from the preliminary shaft in the direction of the main tunnel. At the west side of Mount Macdonald the pioneer bore enters the slope several hundred feet above the cutting. It takes a downward course for the first 300 feet on a 50 per cent. grade. Then it goes straight forward and ahead to the mapped-out course parallel with the main tunnel. The pioneer shaft at the eastern portal is now 3,000 feet into the heart of the mountain and over a thousand feet of the main tunnel has been driven. A feature of the boring operations in the soft material at the start of the main tunnel at the western end was the use of hay to knit together the earth and water which oozed out as the excavation proceeded. The hay was placed in handfuls between the wooden supports used to keep the preliminary shafts from falling in.

(Ottawa River Water Supply)

two fifty-four inch steel pipes, laid beneath the bottom of the river and surrounded completely by concrete. These pipes will be laid to the suction well in the low level pumping station from which the water will be taken by the pumps. An emergency intake will be provided in this well.

The low lift station will be a reinforced concrete structure equipped with four centrifugal pumps with capacities of thirty-five millions, eighteen millions, twelve millions and five millions in gallons daily. All pumps will be direct-connected to electric motors, and, in addition, as a precautionary measure, to a steam turbine. Provision is made in the station for the installation of another thirty-five million gallon unit.

The pipe lines from the pumping station to the purification plant, and from the purification plant to the Queen Street pumping station, will be duplicate lines of forty-eight inch steel pipe. Where the lines cross streets, railroad tracks and other points where special protection is desirable, the pipes will be surrounded by reinforced concrete.

The report describes in detail the process of filtration and the application of the chemicals. The main points of constructional interest have been outlined in this abstract. It may be of interest to know that unqualified approval of the scheme has been given by Mr. J. Waldo Smith, Chief Engineer of the New York City Waterworks.

The necessity of the establishment of a Government Department of Municipal Affairs was urged upon the delegates to the annual meeting of the Ontario Municipal Association at Toronto last week by Mayor Carter, of Guelph, and other speakers. Mr. Carter had no hesitation in saying that only five per cent. of the men elected to municipal bodies understood their business or were familiar with the conduct of municipal department.

Wall and Column Footings in the Design of Masonry Structures

FOOTINGS form an important element in the design of masonry structures. The two forms of footing most commonly used may be named the wall footing and the column footing, the former projecting laterally on the two sides of a longitudinal wall and the latter extending in four directions from the base of a column or pedestal block. It is usually assumed in the design of foundations that the earth conditions are such as to make the upward pressure on the footing uniform over its surface. Wide differences exist in methods of designing, due to differences in the assumptions made with reference to the structural action of the footing. It is not strange that these differences exist, since few or no experimental data are available which apply directly to the conditions of footings. Relatively short and deep beams and slabs under heavy uniform loads, with the supporting pressure largely concentrated at the centre of the structure, may not be expected to give the same results as have been obtained in tests with the more slender beams and slabs and with the methods of support and of application of load which have generally been used in tests. With the present extensive application of reinforced concrete to footings, a more definite knowledge of the structural action of footings has come to be of importance. It is appreciated that the tests herein described are applicable only to a limited field, but they are offered as a contribution on a subject in which little experimentation has been done

The investigations were made in the Laboratory of Applied Mechanics of the University of Illinois as a part of the work of the University of Illinois Engineering Experiment Station.

The tests of 114 wall footings and 83 column footings are described in the Bulletin.* The wall footings were 12 ins. wide, generally 5 ft. in length and 12 ins. in depth, or 10 ins. to the centre of the reinforcing bars, with a 12-in. by 12-in. by 12-in. stem in the middle to represent the wall through which the test load was applied.

The wall footing rested on a bed of springs arranged in such a way as to approximate conditions of uniform upward pressure on the bottom surface of the footing. A variety in method of reinforcement was employed to throw light on the development of tensile stress in the steel and on the resistance to bond, diagonal tension, and shear. Tests of brick footings, unreinforced concrete footings, and footings having I-beams encased in concrete were included in the investigation of wall footings.

The column footings were 5 ft. square, and generally 12 ins. thick or 10 ins. to the centre of the reinforcing bars, and had a 12 by 12 by 12-in. pier built over the middle through which the load was applied. The column footings also were tested on a bed of springs which gave conditions approximating those of uniform upward pressure. Variety was given to the amount and method of reinforcement and to other conditions with a view of determining the structural action with respect to tension, bond, diagonal tension, and shear, and to give information which would bear upon methods of calculation of stresses. It is thought that these are the first experimental tests on column footings, and probably the first on wall footings on a bed of springs. Analyses are given of the stresses in wall footings and column footings and methods of calculation are discussed and compared with the results of the tests.

General Theory

In wall footings and pier footings the weight or load is applied vertically through the wall or base block or pier, and the upward bearing pressure of the soil (which may also be called the load, since its amount and distribution determine the stresses) supports this weight from below. The usual assumption on which the design of footings is based is that the soil pressure is uniform over the bed of the footing. Before uniformity of pressure on the footing will obtain, the footing must bend to the amount and form which would be caused by a uniformly distributed load. The assumption of uniform pressure is warranted if the earth layer is an elastic compressible soil of considerable thickness and of not too high a modulus of compressibility, as under these conditions the amount of bend of the projection of the footing is slight in comparison with the amount of compression of the earth. Also, in soft soils which flow laterally, as in a so-called "floating" foundation, the settlement and changes in the soil will produce conditions approximating uniform pressure. Where the bed is rock the pressure will be transmitted more nearly directly from the wall or pier to the rock, and as the projections of the footing have little opportunity for being bent upward this portion of the footing may be expected to take only a small part of the load.

Analysis of Wall Footings

Fig. 1 (a) shows a wall footing and a typical set of external forces acting upon the footing. In the discussion, the stem or pier above will be called the wall, and the remainder the footing proper. The projecting portion of the footing will be called the projection.

The bending moment at a section of the footing x distant from the end (calling w the uniform upward pressure per lineal foot of length of footing for a given width of section) is

$$M = \frac{1}{2} wx^2 \ldots\ldots\ldots\ldots (1)$$

For a section at the face of the wall, the bending moment will be

$$M = \frac{1}{8} w\,(l-a)^2 \ldots\ldots\ldots (2)$$

where l is the extreme dimension of the footing and a is the thickness of wall. For a section through the middle of the wall, assuming the load to be distributed uniformly over the wall, the bending moment will be

$$M = \frac{1}{8} w\,(l^2-la) \ldots\ldots\ldots (3)$$

The variation of the bending moment along the footing is shown in Fig. 1 (b).

Although the maximum bending moment is shown by the above analysis to be at the section which passes through the middle of the wall, the resisting moment of that section will be far greater than that of a section of the projection of the footing in those cases where the wall and footing are poured at the same time or where they are well bonded together. Even with a weak bond the horizontal shearing stress at the junction of wall and footing will, in footings of the ordinary proportions, be so small that the combined section may be expected to act together. Besides, the pressure from the wall, instead of being distributed as shown, will be concentrated to some extent on the footing near the faces of the wall, as at A, Fig. 1 (a), and this will act to reduce differences of moments. Altogether, it may be expected that the section at the face of the wall will be the critical section for bending moment and resisting moment and that equation (2) will express the value of the critical bending moment as closely as may be determined by ordinary analysis.

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* University of Illinois Bulletin, No. 67.

Fig. 1 (b) shows also the variation in the external vertical shear V over the length of the footing for uniform loading. The theory of beams gives a distribution of the intensity of the vertical shearing stresses throughout the vertical section which is represented in Fig. 1 (c) . Due to a concentration of pressure near the face of the footing, as at A, Fig. 1 (a), and to the transmission of pressure, diagonally therefrom in a manner which is analogous to arch action (as is also to be found in short simple beams), it may be expected that at vertical sections near the wall the vertical shearing stresses will be greater in the compression portion of the vertical section and less below the neutral axis than is given by beam analysis.

This modification of the distribution of the vertical shear stresses may be expected to reduce the amount of the diagonal tension stress developed near the wall, and the position of the critical section for diagonal tension failure may be expected to be away from the face of the wall. The load stres sbetween the surface of the horizontal reinforcement and the concrete will also be affected by variations from true beam action.

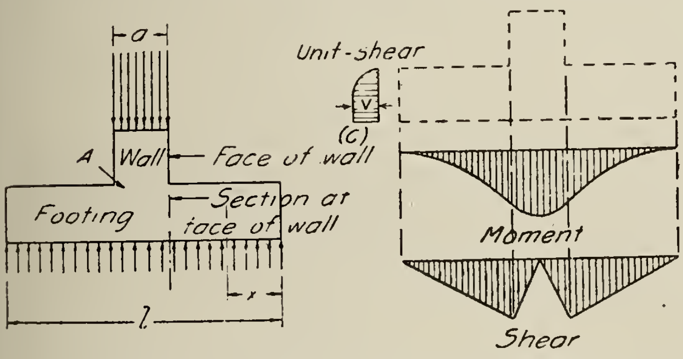

Fig. 1 [a]

Fig. 1 [b] and [c]

[a] Distribution of load and pressure in wall footing; [b] moment curve and shear curve; [c] distribution of shearing stress over vertical section.

When footings are tested on a bed of springs, the deflection produced results in compressing the springs at the middle of the footing more than at the ends, and hence the pressure will not be uniformly distributed along the length of the footing. If the compression of the springs at points along the length of the footing is known, and also the deflection of the footing at these points, the distribution of the load may be determined and the resulting bending moment calculated. Fig. 2 illustrates the effect of the deflection of the footing upon the distribution of the load. The bending moment so calculated will be somewhat less than that based on uniform distribution of the load, and the amount of the resulting tensile stress, bond stress, and vertical shearing stress will be less. The amount of the difference will depend upon the stiffness of the springs and the deflection of the footing under load, but within so-called critical loads it will not be large. Of course, in designing footings, our knowledge of the distribution of the pressure by the soil is too imperfect to consider the effect of deflection upon distribution of pressure.

Analysis of Column Footings

In the column footing of the form used in the tests, the stem representing the bottom of a column or a pedestal block will be termed the pier, and its lateral faces the faces of the pier. The load will be considered as applied uniformly over the top of the pier, and the upward pressure as uniformly distributed over the lower surface of the footing. It is seen that the footing may be considered to be a cantilever slab (rather than cantilever beams) supported at the top over a central area and loaded uniformly by an upward load, and that as the projecting portion of the footing deflects upward its surface will be bowl-shaped, in reality a double-curved surface. The determination of the distribution of the stresses over the various parts of a column footing is a much more difficult problem than is presented in wall footings.

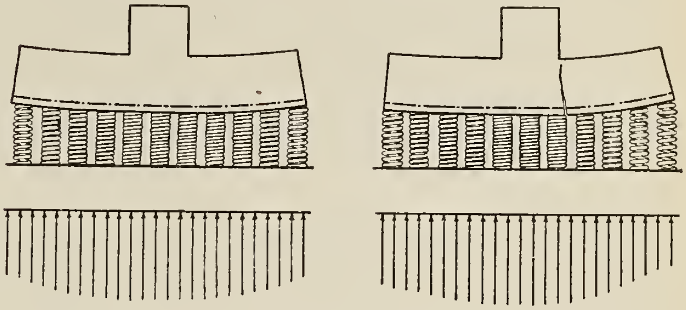

Fig. [2]

Effect of deflection of wall footing upon distribution of load by springs.

Various methods of calculating the strength of column footings have been proposed. In some cases the offsets have been considered as cantilever beams having the full width of the footing and the full load on this area is considered to be taken by this beam, the critical section being at AB, Fig. 3. Although the load at the corners is counted twice, the error is not great when the offset is small in comparison with the dimensions of the pier. If the dangerous section is considered to pass through the centre of the footing, EF, Fig. 3, a greater discrepancy exists. A common method of design is to consider that one-fourth of the total load is applied on the triangle EFG, Fig. 4, and having found the centre of pressure (as H) of the part of the load at one side of AB or CD (according to which is used as the dangerous section), to calculate the bending moment as the product of this amount of load by the distance from this centre of pressure to AB or CD, the dangerous or critical section.

When the bending moment has been obtained by one of these methods, it is considered to be resisted by a beam IKLM, Fig. 4, of width somewhat greater than the width of the pier, say, the width plus once the depth of the footing, according to the views of the designer. That is to say, the reinforcement in this assumed width is considered to develop stresses which altogether are sufficient in a beam of the depth of the footing to withstand the calculated bending moment. If the cross-section of the steel lying within the assured width is A, the resisting moment will be $M = Afjd$, where A is the area of cross-section of longitudinal reinforcement; f is the tensile stress per unit of area in the reinforcement; j is the ratio of the distance from the centre of the longitudinal reinforcement to the centre of gravity of compressive stresses to the distance d from the compression face to the centre of the longitudinal reinforcement. The steel lying outside the dotted lines is considered to carry load to the beam formed by the reinforcement which lies at right angles to these lines, just as the steel parallel to and near FG carries load to the beam IKLM, and in this method of design no account is taken of it in the main beam. Whether the spacing of the outer bars should be the same as that of the interior or be greater is then left as a matter of judgment. In the determination of both bending moment and resisting moment, then, the practice of engineers varies considerably.

A rational analysis of the stresses would involve a determinate expression for the deflection of the footing at every point of the cantilever slab and also for the radius of curvature in each direction. A full treatment would include a consideration of the effect produced by having stresses act at right angles to each other, and of the action of other combined stresses.

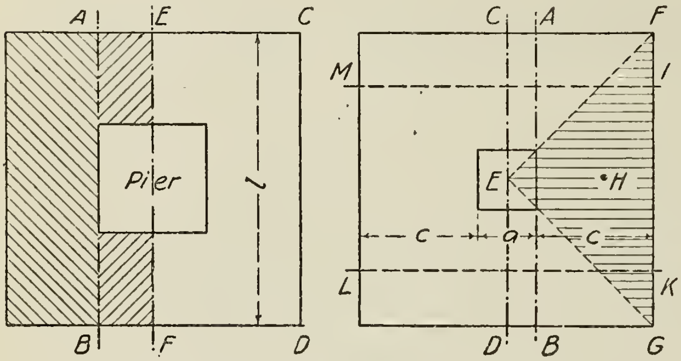

Fig. 3 Fig. 4

Loaded areas assumed in designing column footings.

It is easily seen that an analytical treatment of a cantilever slab of this kind which approached completeness would be very complicated. This and the uncertainty involved in the assumptions made at some steps of the analysis render the correntions of the results of the mathematical work of such an analysis quite problematical. In view of the complexity of the problem and the uncertainty of portions of the work, it seems futile to attempt to derive thoroughly rational formulae for stresses in column footings.

Details of an interesting and difficult engineering work were lately given by Mr. E. S. Sinnott, M. Inst. C. E., County Surveyor of Gloucestershire, Eng. The operation consisted in the protection of the foundations of Chepstow Bridge over the river Wye, by means of Mouchel-Hennebique ferro-concrete piles, after the removal of the old timber work. The task was rendered difficult and tedious by the great rise and fall of the tide, and by the fact that under the most favorable conditions two hours per tide was the available limit of working time. Each day the contractors' plant had to be cleansed from the sticky mud deposited by the previous tide, the pile frame being entirely submerged every twelve hours. Although the operations were carried on continuously day and night for over a year and a half, no fatal accident occurred, but the pile engine was once displaced by the force of the water.

Dangers in Bank-Run Material

To obtain good concrete, accurate proportions are necessary. If correct proportions are not specified, or if the specified proportions are not observed, high quality cannot be obtained. When a 1:2:4 mixture is specified, there is no excuse for allowing a 1:6 mixture of cement and "bank-run" aggregate. Such a statement seems entirely unnecessary, says "Engineering Record," and yet the rule is being daily disobeyed.

If the gravel pit is close at hand, a peculiar mental inertia seems to overcome the contractor, in consequence of which, the cement is mixed with the bank-run material, without separating the sand and gravel and remixing in the correct proportions. This is bad practice, since in practically every bank the sand is generally twice the volume of the coarse material. But, to make matters worse, if a 1:2:4 mixture has been specified, the contractor thinks he will meet the specifications by using 1 part of cement and 6 parts of bank-run. Thus, instead of approximately one-quarter of a cubic foot of cement per cubic foot of concrete, only 1/6 of a cubic foot is obtained.

The idea then occurs that rather than take the trouble to separate the fine and the coarse materials, good concrete can be obtained by using 1 part of cement and 4 parts of the bank-run, but in most gravel banks the sand is about double the quantity of the coarse gravel, instead of the reverse which is to be desired. Thus, not only is less cement used per cubic foot of concrete, but the strength is decreased by the excess of sand. A report of analyses on samples of cement and bank-run, mixed in the proportion of 1 part of cement to 4 parts of the mixed sand and gravel, indicates that the mixture runs about 1:2¾:1¾, giving a weaker mortar and a smaller yield than the 1:2:4 combination.

Accurate proportions can be brought about only by the use of separate materials of known size and gradation. The contractor will be repaid for the expense of screening by the greater yield per barrel of cement; and the owner will secure a better, more uniform concrete.

Uniformity is impossible when bank-run gravel is used. There are many engineers who will question this statement, on the ground that it is always their practice to screen out a small sample, from which the amount of coarse material to be added is determined. The folly of this method of proportioning can be proved by screening samples from various parts of the same pit, which will show variations all the way from plastering sand alone to coarse gravel with no fine content whatever. No two wagon loads coming from the same pit will have the same proportions of sand to gravel—a strong argument for separation and remixing.

Good concrete, then, requires accurate proportioning of aggregate as well as accurate measurement of cement. To secure it, two points should be strongly impressed on all who write specifications or are entrusted with their enforcement: First, that the proportions must be correctly stated and adhered to; second, that accurate measuring of the separated aggregates must be insisted upon.

Methods of Sampling Sewage and Other Liquids*

By G. Bertram Kershaw

A very usual object for which samples of sewage and various other liquids are taken is to ascertain the chemical or bacterial quality of the liquid sampled, and thereby to determine the degree of efficiency with which a particular plant is performing its functions; as, for example, the purification effected on a particular sewage by tank treatment and percolating filters. Again, samples may be taken simply with a view to finding out whether the quality of the liquid produced complies with a particular standard.

In the former case, in order to be in a position to judge of the efficiency of the plant, it is necessary to know the strength and character of the sewage as well as the quality of the effluent. In the latter case this is unnecessary, the sample either passing or failing to pass a given standard.

It is of the highest importance that the sample analysed shall be duly representative of the bulk of liquid from which it is taken, otherwise erroneous deductions may be drawn. Inasmuch as quantitative analyses are necessarily somewhat costly, and gauging arrangements often involve a good deal of trouble and expense, it is very advisable, on these grounds alone, that the sample or samples drawn shall be as nearly representative as possible.

Nearly all waste liquids, especially those resulting from industrial processes, vary, not only in character but also in volume, from minute to minute, from hour to hour, and from day to day. Sewages, moreover, may also vary seasonally by reason of the influx of subsoil water and other factors; they vary markedly when heavy rainfall occurs.

If it is desired to ascertain the quality of a particular liquid at any given time, a single sample (termed a "chance" sample) will often suffice for the special or casual purpose for which it is taken. If, on the other hand, the character and strength of the liquid as a whole is what is to be determined average samples will be essential—that is to say, samples drawn according to the rate of flow of the liquid over at least four days.

Sewage Liquors

It will be obvious in the case of sewage liquors, which in dry weather vary in strength roughly according to the rate of flow, that if the hourly proportional flows for five consecutive hours are 10,000, 30,000, 50,000, 60,000 and 20,000 gallons, then samples merely drawn in equal quantities every hour will not represent the average strength of the liquid for the five-hour period unless the sewage is hourly of constant strength; whereas, if the samples are drawn hourly according to the rate of flow in quantities or, say, 100 c.c., 300 c.c., 500 c.c., 600 c.c., and 200 c.c., and mixed together, an average sample closely approximating to the truth will result. It follows, therefore, that in sampling for average strength the hourly rate of flow of the sewage must be ascertained; in other words, the flow must be gauged continuously while sampling is in progress.

Average samples of sewage liquors were taken as long ago as 1872 by the committee of the British Association at the Romford sewage farm, and probably long before that date, for liquors other than sewage. Average samples of sewage liquors have also systematically been taken by the Sewage Disposal Commission appointed in 1898, and it may be of interest to describe the method of taking average samples of sewage from start to finish, since sewages and sewage liquors are more likely to prove of general interest than the sampling of waste liquors from manufacturing processes.

The first preliminary to be settled is the duration of the period over which the samples are to be taken. In the majority of cases, four sets of twenty-four hours average samples, commencing Monday morning and ending Friday morning, will give a good idea of the character and strength of the sewage. In the case, however, of a large town, sets of average samples extending over seven days, repeated at different seasons of the year, may be necessary. In the case of domestic sewages from small communities, the first four or five days of the week usually constitute a sufficient period to provide data upon which, say, works could be designed; the omission of sampling the Saturday and Sunday sewage, which is often weaker than normal on these particular days, provides a certain factor of safety.

It is always desirable to draw average samples of sewage in dry weather, and hence it is necessary to determine what shall be regarded as dry-weather sewage flow.

The extent to which rainfall will affect the sewage flow will depend very largely upon local conditions, such as the nature of the sewerage system, the character and gradients of the surfaces of the drainage area contributing to the sewers, together with many other factors; but it depends, other things being equal, chiefly upon the intensity of the rainfall. For example, a rainfall of .05 in., or even more, following dry weather, and spread evenly over several hours, may produce little or no appreciable effect upon the flow of sewage, certainly not sufficient to put a stop to the taking of samples; but the question of continuing or abandoning drawing of samples must be left to the discretion of the sampler, who will generally be able to gain some idea from the sewage works manager as to whether or not the sewage flow is being materially affected by rainfall.

If two or three days precede the sampling operations, so much the better; but it is impossible to predict seven to ten consecutive days of dry weather in this country.

Since an automatic height recorder in connection with the gauging operations is advisable whenever it can be obtained, it is a good plan to fix a weir and run the recorder for seven to ten days before actually commencing sampling, thus obtaining a series of charts showing the general run of the sewage flow;

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* Paper read at the recent Annual Congress of the Royal Sanitary Institute of Great Britain.

comparison with these charts when rainfall occurs will generally show when it is inadvisable to continue sampling for the time being.

With regard to rainfall records at most sewage works of any size, a rain gauge is kept on the works, but if there is not one in use, a 5-in. gauge is easily erected, and records should be taken at 9 a.m. daily during the sampling. If a rain gauge is to be found in the town itself, daily records should be obtained from this source also, as it by no means follows that the rainfall in the town and on the works will be identical.

Apparatus

Now, as regards the apparatus required for taking twenty-four hours average samples of crude sewage, about thirty, or, better still, thirty-six wide-mouthed glass-stoppered bottles will be needed for chemical analysis; the use of the extra bottles (apart from chance of breakage) will be apparent later.

If samples for bacterial analysis are needed, a few small glass-stoppered sterilized bottles will also be wanted; these will generally be sent ready sterilized direct from the laboratory, and one or two of such bottles can be filled from the large mixing bottle when the twenty-four hours' average sample is made up. The stoppers of all the bottles; both chemical and bacterial, should be carefully ground in with fine emery, and the foot of each stopper rounded to avoid shutting in air bubbles.

As regards capacity, the larger bottles should hold about 600-700 c.c. each, and the sterilized bottles about 50 c.c. each. A large glass mixing bottle, holding about 1½ gallons, will be wanted for making up the average sample from the twenty-four separate hourly samples, and also a couple of thick glass stirring rods, and a measuring glass graduated in cubic centimeters; two thermometers, grease chalks, two or three drying cloths, and some adhesive labels complete the outfit. The bottles used for holding the mixed twenty-four hours' average sample are generally half-winchesters, holding about 1,300-1,400 c.c. each; but for special purposes a winchester is sometimes required.

Turning to the gauging outfit required: The method of gauging employed will depend upon local conditions. Whenever practicable, a wooden dam, with a brass or gunmetal rectangular weir plate screwed to the face of it is the simplest method, the whole of the flow to be gauged passing over the weir, and the depth of liquid over the weir sill being registered continuously by an automatic height recorder. "Plastic," or a mixture of clay and boiled linseed oil, is useful for making watertight joints between the margins of the wooden dam and the channel walls.

It may be well to point out here that to avoid complications in the formula for discharge, owing to the existence of material velocity of approach, one or two points need to be kept in mind.

(1) The width of the weir should not exceed about one-third the width of the channel in which it is placed.

(2) The transverse sectional area of the liquid falling over the weir should not exceed about one-fifth of the transverse sectional area of the liquid in the channel immediately above the weir.

(3) The weir and dam board should be perfectly upright, and have a free overall and air space underneath the falling sheet of water, while the float of the automatic recorder should be placed sufficiently far back from the weir to avoid curvature of surface.

As to the type of recorder, I have always used a small portable Glenfield and Kennedy machine, the drum being driven by a seven-day clock, and the pen actuated by the up and down movement of the float. There are, however, several automatic height recorders on the market, some of them with pen or pencil cams cut to give the discharge direct upon the chart. It is not, however, a difficult matter for any engineer to construct a simple and reliable machine for comparatively little outlay. Care is required in adjusting the pen to zero on the chart, which should be carefully pressed down to the rim at the foot of the drum.

Most recorder pens have an up and down range of 6 in., so that the depth over the weir must be limited to about 6 inches, unless the minimum early morning flow exceeds, say, 1½ inch depth over the weir, in which case the recorder can be made to register up to 7½ inches by setting the pen at zero on the chart when exactly 1½ in. of liquid is passing over the weir, the chart base line thus reading 1½ in. above sill level. The recorder should be set up perfectly level, and the float, if in an exposed situation, should be surrounded by a cylinder of fine perforated zinc, to eliminate wind action, otherwise oscillation of the float will soon exhaust the ink in the pen, besides blurring the chart. It may be mentioned that a mixture of glycerine and charcoal, or any aniline dye, makes a good ink for a recorder pen.

Having erected the weir and recorder, the sample bottles should be prepared and the time for commencing settled. Assuming 9 a.m. to be the hour determined upon, and that average samples of crude sewage are to be taken, the recorder should be started at 9 a.m., the second at 10.30 a.m, and so on hourly until 8.30 a.m. the following morning, when the first set of twenty-four hourly samples will be complete. The filling of each bottle is usually most conveniently done at the weir outfall.

It will be found convenient to write on each bottle the nature of the liquid, the date, and the hour of drawing; this can be done with grease chalks upon the glass direct, or adhesive labels can be used.

As each hourly bottle is filled the stopper should be allowed to sink down gently into place in the bottle neck; if this is not carefully attended to there is considerable risk of casualties when an attempt is made forcibly to unstopper the bottle. After stoppering the bottles should be set in a row in the order of the times at which they were filled. It will be found, when the twenty-four bottles are ranged in a row, that a wonderfully good idea can be obtained visually of the variations in the character of the sewage throughout the twenty-four hours.

Procedure

A point now arises as to the inclusion of fragments of faeces in a sample. Although they are usually omitted when taking chance samples direct with half-winchester bottles, this would appear to be a faulty method of sampling in certain cases, especially where the crude sewage subsequently undergoes treatment in septic tanks. If they are included they will need to be broken up in the hourly sample bottles before the proportionate amounts are drawn off.

After the last of the twenty-four hour samples has been taken, and the recorder pen has reached the 9 a.m. ordinate on the chart, the chart can be removed and replaced by a fresh one, and the hourly rates of flow worked out and entered up on the finished chart. The date, rainfall (if any), and other notes of interest should be recorded, such as times of weakest and times of strongest sewage, flushes of trade wastes, etc. For working out the hourly flows on recorder charts I use a special slide rule, which has the advantage of shortening the labor considerably. In the case of a recorder provided with a cam, the discharge can, of course, be taken direct from the chart; but with a recorder that only registers the height, height diagrams have to be translated into discharge diagrams.

The next step is to take from each bottle, commencing with the 9.30 sample, an amount proportionate to the rate of flow for each hour, and to transfer it to the large mixing bottle. Assuming the flow for the first three hours to have been severally 5,000, 6,500, and 8,500 gallons per hour, then if 50 c.c., 65 c.c., and 85 c.c. are taken from the first, second, and third bottles respectively, these amounts will be proportionate to the rates of flow for those hours, and the same procedure must be followed with the twenty-one remaining hourly samples.

The measurement of the liquid from the hourly sample bottle is best effected by means of a tall glass cylinder graduate in cubic centimetres. Before the sample bottle is unstoppered it should be turned over once or twice to mix the contents, and large solids should, if present, be broken up with a glass rod. In many cases the hourly amounts to be taken from each bottle can be obtained by knocking off two or more figures from the right of the hourly rates of flow, and if the figures thus obtained are inconvenient, the whole of these can be either divided or multiplied by a common factor. Care should be taken that the aggregate of the figures adopted are sufficient to yield enough liquid for the final sample; and it is better, if this can be done, to take sufficient liquid to fill two half-winchesters in case of breakage of one of them.

The working out of the chart and the sub-sampling, together with the entering up in the proper hour spaces of the chart of the times of strongest and weakest sewage, presence of trade wastes, etc., take some considerable time; and while this record is in progress the reserve bottles previously mentioned will be needed to take the first few hours of the second set of samples.

When the proportionate contents of the twenty-fourth hourly sample bottle has been transferred to the mixing bottle, the whole of the contents of this large mixing bottle should be gently agitated while the half-winchester bottle or bottles are being filled from it, in order to keep the suspended solids evenly distributed throughout the liquid. After the half-winchesters are thus filled the hourly sample bottles can be emptied, washed out with clean water, and set to drain. In cold weather, half-winchesters, or winchesters filled with sewage, tank liquor, or effluent, should be filled brimful, and the stoppers gently worked in, and tied down with a piece of calico or string; in hot weather, and also in keen frosty weather, a small air space may be left at the top of the bottle in the case of sewages or tank liquors. The samples should be despatched to the laboratory carefully packed in wicker cases or hampers, nothing being better than old crumpled newspaper for packing the bottles in. It is often useful to have a special sample of the weakest early morning sewage, taken in a half-winchester, to be examined for nitrates. These, if present, indicate the presence of subsoil water in the sewage.

It may be noted that in the case of very small sewage works, where an automatic height recorder cannot be obtained, depths over the weir can be taken with a thin steel rule, one edge of which is ground thin. Depths should be taken sufficiently far from the weir sill to avoid curvature, and it will be found that if the rule is rubbed lightly against a block of wet clay and allowed to dry before each reading, the exact depth can easily be seen at a glance. The gauging of sewage flows in this way is very tedious, since readings should be taken every ten minutes, or at even shorter intervals, should the flow of sewage fluctuate much, as will almost certainly be the case with a small sewage works. At least three observers are needed for the twenty-four hours for taking sill depths and drawing samples.

There is another method of taking average samples, in which samples are taken at regular intervals throughout the twenty-four hours, each of these samples being analysed separately; a "weighted sewage" can be obtained by multiplying each separate analysis by the rate of flow at the time the sample was taken, the results are then added up and divided by the total flow.

Some years ago the writer, having occasion to take a large number of average samples, designed an instrument for taking samples directly proportionate to the rate of flow in one operation. Briefly described, the instrument consisted of a paraboloid copper tube or container, about 12 inches long, ranging from about ⅝ in. at the bottom to about 2¼ in. at the top, the several diameters being calculated from the gauging formula. This tube was attached to a sliding metal stem working up and down in sockets screwed on to a rod provided with a thin sole plate, upon which the tube rested when the sample was taken. When in use the tube was raised clear of the sewage tank liquor or effluent, and the sole plate placed on the measuring stud, which was about ⅛ in.—i.e., the thickness of the sole plate—below the level of the weir sill. The tube was then dropped through the liquid on to the sole plate, and the intercepted liquid poured off direct into the mixing bottle; a thin rubber pad lying in a recess in the foot or sole plate prevented any escape of liquid, while a strong clip at the head of the instrument kept the container tube well home against the rubber. In this way, at each sampling, a portion of liquid was withdrawn proportionate to the flow of liquid; in other words, proportionate to the height of liquid flowing over the sill. Like most automatic contrivances, however, while possessing many marked advantages with certain liquids, containing suspended matter of moderate size, it had also several drawbacks, and the longer and more tedious method already detailed is to be preferred in most cases.

There are home-made automatic samplers to be seen in use at several sewage works, most of them actuated by a small water-wheel driven by a flow of sewage, tank liquor, or effluent.

Tank Liquors and Effluents

The sampling of tank liquors and effluents is effected in a similar manner to that already described for sewages, and it is easier, because less complicated by solids; and when both sewage, tank liquor, and effluent are sampled at the same time, it is often convenient to draw what are know as "corresponding samples." By corresponding samples is meant the taking of two or more samples of the same liquid in its different stages, a certain interval of time or "lag" elapsing between the drawing of each of the said samples. For example: assuming a sewage to be flowing at a uniform rate into a tank having a six-hours capacity, and that a sample of the sewage is drawn as it enters the tank, a sample of the tank liquor taken six hours later will be a sample—other things being equal—corresponding to the sample of sewage.

It is often necessary to use dyes, such as fluoresin or eosin, in order to follow the progress of a particular liquid through several processes . For example, if the temperature of a liquid entering a settling tank is much higher than that of the liquid in the body of the tank, short cuts through the tank at the surface are almost certain to occur, and a dye, such as fluoresin, shows this at once. Samples should be taken just before the dye reaches the sampling point to avoid including the dye in the sample.

Corresponding samples are also exceeding useful in showing the relative amount of work brought about by the several stages of a purification plant; the only objection to them is the time occupied in obtaining a complete set. It may be noted that the chlorine figures on analysis will usually but not invariably, show whether the samples of sewage liquor correspond properly.

Effluent From Contact Beds

With regard to the taking of samples of effluent from contact beds, it is well known that the quality of a contact bed effluent varies considerably as the bed is being run off, being worst when the outlet valves are first opened, afterwards gradually improving until the bed is practically empty. It has also been found to be the case that samples taken at the period of midflow from the bed, approximate closely to the average quality of the whole of the effluent discharge, and it is therefore sufficient, in the majority of cases, to take a sample at mid-flow from each particular bed discharge, and to mix the whole of them together to make up the twenty-four hours' average sample.

Storm-water samples can be taken automatically, if desired, by fixing a vessel on the side of the storm overflow manhole at the level at which the required dilution occurs.

Care should be taken in sampling all sewage liquors that no sediment is stirred up in any channel or manhole and mixed with the sample, otherwise the sample becomes worthless. This is of especial importance in taking samples of effluent.

It is, perhaps, not generally realized how much effluents vary in composition in the course of the twenty-four hours, even in the case of land effluents, and when it has been customary to take a sample of effluent regularly at the same hour daily, it is often surprising to see the difference shown by average samples taken over the whole twenty-four hours.

Trade Wastes

The sampling of trade wastes stands on a different footing to the sanding of sewage liquors. A thorough working knowledge of the particular trade in question is needed if the sampler is to take representative samples. Trade wastes vary in character in short intervals of time, owing to the different operations which are frequently in progress at the same time at the one manufactory, as, for example, where bleaching, printing and dyeing are carried on simultaneously at the same works, as is often the case.

In the case of many trade wastes, when taking average samples it is advisable to take a sample every five or ten minutes owing to their rapidly varying character, and each separate sample should be tested with litmus for acidity or alkalinity, and the temperature noted. It is frequently desirable to take samples of each of the various liquors from a manufactory as well as of the general or mixed waste; in such circumstances, difficulties in arranging the flow are apt to arise, the contents of vats being let off with a rush in the space of a few minutes, the chart of the recorder consequently showing an abrupt vertical line which cannot be integrated for discharge. In such cases a number of dip samples may be taken, and the capacity of the vat or tank taken, and noted in pencil on the chart at the proper point.

At some manufactories with which the writer is acquainted, a variety of gauging expedients have been necessary in order to arrive at accurate information as to the volume of discharges.

Most trade-waste investigations demand a rather elaborate scheme to be laid down before satisfactory sampling can go forward, and since the analysis of many of these wastes is laborious and intricate, and consequently costly, it is very advisable that, as in the case of sewage liquors, the samples shall be as far as possible representative of the liquids from which they are drawn. Many trade wastes, it may be mentioned, do not, owing to their nature and colour, admit of the use of eosin or fluoresin for tracing the various liquids through their several processes.

River Samples

River samples require considerable care in taking, especially where large rivers are concerned, and where bacterial samples are in question; the boat from which the sampling is done often itself carries contamination on its sides at the water line. All river samples should, wherever practicable ,be cross-sectioned ones—i.e., a number of samples should be taken on a line normal to the axis of the river—and these should be mixed together for the final samples.

For the taking of surface samples in large rivers, I have found two glass tubes of ⅜ in. internal diameter wired together, and about 18 ins. long, exceedingly useful. As a boat is rowed very slowly along the section line, dip samples are rapidly taken every 6 ft. or so, alternately 6 in. and 2 in. deep, and the fingers or palm of the hand closed over the top apertures of the tubes, which are then quickly emptied into a glazed earthenware pail. If corresponding samples are needed, the river water should be coloured with fluoresin when the first set of samples are taken, and practically the same body of water can then be detected and resampled lower down. Two or more samplers are needed for taking the second sample as quickly as possible just before the dye reaches the cross-section. To those who have been accustomed to judge the average velocity alone, the slow average rate of flow shown by the fluoresin will come as a revelation.

There are many other ways of taking special samples, such as deep-well samples, many of them requiring specially designed and expensive apparatus, but they are perhaps of special and not general interest, and for that reason they are not included in this paper. In conclusion, it may be observed that, although the procedure involved in obtaining true average samples may appear at first sight to be too refined for general use, it should be carefully borne in mind that a substantial error in the strength and character of a sewage—such as may very easily arise if a few casual samples taken at haphazard are relied upon—may be the cause of sewage purification works being constructed not competent to bring about a proper degree of purification of the sewage they are called upon to treat.

The Prevention of the Sub-Crust Movement in Roads

By E. S. Sinnott, M. Inst. C. E.*

FROM time to time the writer has had under his observation the behaviour of roads subjected to heavy traffic, and he has recently initiated certain experiments to determine, as far as possible, the lateral and longitudinal movement of material forming the sub-crust of highways.

As a preliminary to more precise investigations, he has arranged during the past few months for various sections of grass verge adjoining the principal roads in Gloucestershire to be opened, and some of the results of such openings are shown.

Speaking generally, these indicate that lateral movement, in some instances to a considerable extent, has been taking place, and such movement seems to call for special consideration.

The following examples will serve as illustrations:—(i.) On main road (Gloucester to Bristol) at Whitfield, near Falfield. At this point the grass verges were opened on both sides of the road, and on the west side there was found, at a depth of about 4 inches, a bed of broken limestone having a width of 3 ft. from the metalled surface, varying in thickness from 7 ins. nearest the road to 4 ins. at the three feet distance. On the east side a somewhat similar state of affairs was found to exist, the width in this case being 2 ft. 6 ins. from the verge. The subsoil is a hard red clay. (ii.) On main road (Bristol to Malmesbury) near Chipping Sodbury. In this instance the lateral thrust is shown in the movement of a line of channelling formed of three stones on edge put in to protect the foot of a bank; originally laid with a horizontal face of thirteen inches in width, the stones have been forced into a vertical position, having moved through an angle of 90 deg. In several instances the upper stones have been forced completely over, having rotated through an angle of 180 deg., and have fallen backwards into the highway, their movement away from the road being arrested by the bank they were put in to protect. The subsoil is clay.

(iii.) On the main road (Gloucester to Bath) between Hardwicke and Stonehouse. In this case metalling and pitching have been found from three feet to five feet from the metalled surface, and about eighteen inches in thickness. The subsoil consists of clay and sand.

(iv.) On the main road (Cirencester to Cheltenham) at Baunton Hill. The opening at this place showed that the original pitching and oolite macadam had been forced for a distance of four feet from the edge of the metalled surface, the outer end showing an upward movement. The subsoil is clay.

The results above described indicate generally the position of affairs upon roads where traffic is heavy, although in a small minority of cases investigated little or no movement could be detected. It appears evident, however, that where lateral spread does occur it cannot fail to be ultimately destructive, as without substantial and immovable support the top coating cannot be kept up to its work, particularly after some wear has taken place, and it becomes a question how far new surfaces of an expensive character are justified before the sub-crust movement referred to has been arrested.

With a view to obtaining more accurate information, the writer has lately placed a number of iron bolts below the surface of certain roads, and has fixed their position exactly by steel tape measurement, so that any movement can be definitely ascertained on a future occasion.

He has also inserted measuring instruments at various places, which consist of two rods arranged to slide one over the other, having plates at their outward extremities, which will enable any movement, either lateral or longitudinal, to be recorded.

As a means of preventing the action above described, the writer has recently designed and put into use a rigid framing, the essential feature of which is that longitudinal and cross members placed at a suitable depth below the surface preclude any movement of the sub-crust, and at the same time provide a means of constructing an impervious arch of tarred macadam to carry the traffic, great additional strength being provided by the longitudinal members for the support of the heaviest road vehicles.

For various reasons, the writer thought it best to construct the frames in ferro-concrete, although timber or other material could, if preferred, be used.

The form adopted after one or two experimental frames had been made was shown.

The longitudinals are 12 in. by 3½ in. (average thickness) by 12 ft. long, and are slightly tapered from top to bottom. The ends of the longitudinals are securely housed at the extremities of the cross ties.

The reinforcement consists of expanded metal 3 in. mesh ¼ in. by 3-10 in., weighing 11½ lbs. per superficial yard, cut into strips 9 ins. wide—in the case of the cross ties this is supplemented in a minor degree with wrought iron round bars of small section at the ends of the same.

A further modification consists of making the longitudinals slightly curved on the inside, in order to withstand lateral thrust more effectively; also, where difficulties due to traffic may be anticipated, in placing the cross ties in position they can be made in two parts and connected in the centre with a bolt or bolts.

In the experimental frames which have been put down, the width between the longitudinals has been fixed at 8 ft., but there is no particular reason for adopting this dimension, other than it appears suitable for dealing with the traffic conditions of rural roads in Gloucestershire, where most of the heavy weights are carried in the central portion of the highways.

If considered advisable, a greater width than 8 ft. may be adopted between longitudinals, or where traffic conditions justify it, the central pair can be supplemented by longitudinals on either side, connected thereto by cross ties similar to those previously described.

The frames have been placed, the top edges of the longitudinals being 6 ins. below the finished road surface, which, from the information at present at the writer's disposal, appears the most suitable position for arresting the lateral movement, also at this depth there would be little or no interference with pipes, and with 6 in. cover over the top side of the longitudinals there appears to be sufficient cushion to avoid any damage thereto.

Dr. Imhoff, of Essen, Germany, the designer of the well-known tank, has cancelled his proposed visit to Canada and the United States. It is fair to assume that the doctor is detained by affairs of pressing urgency.

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* County Surveyor, Gloucestershire, Eng.

Constructional Details of the Concrete House*

THE all-concrete residence can compete with frame or brick as to first cost, and furthermore it is practically fireproof; it is everlasting, and it is the only completely sanitary habitation yet devised for man; its steel reinforcement and monolithic construction make it best adapted to withstand earthquake strain and shock; its great weight in addition to its monolithic steel construction makes it proof against flood and tornado; it fulfils every requirement that could possibly be asked for in a home.

The construction of a concrete house is really nothing more complex than the putting together of the foundation, outside walls, floors, roof, partitions, stairways, columns, and chimneys.

Wall Construction

A 12-in. wall provides, in addition to the 2-in. on the outside for a water table, a ledge 2 in. wide on the inside to support the first floor.

A cellar wall, while it is really a foundation wall, acts as a retaining wall at the same time. It must withstand the weight of the building and also the earth thrust, the latter tending to collapse it. For a cellar 8 ft. deep or less, a 12-in. wall is sufficient. The bottom of it ought to be about 12 ins. below the cellar floor, to provide stability at its base. No reinforcement is needed unless the wall is longer than 30 ft.; then reinforcing should be provided, to avoid shrinkage cracks. If a waterproof wall is desired, it should be reinforced, regardless of size. Suitable reinforcement would be strong triangular mesh or other form of wire mesh, expanded metal fabric, or ¼-in. round rods spaced 1½ ft. apart vertically and 2 ft. apart horizontally. Stones should be set in the top of the wall, embedding half their depth in concrete, to form a bond between the foundation and building proper.

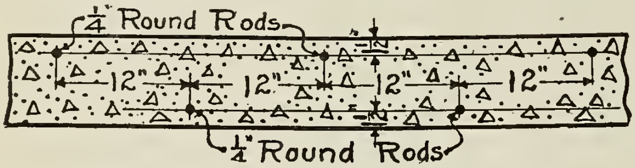

Fig. 1.—Arrangement of vertical reinforcement in walls.

The outside walls should be 8 ins. thick from the bottom up to the under side of the second floor slab or beams, and 6 ins. thick from that point to the top, a 2-in. offset being made on the inner face. The 2-in. ledge formed by the wall is used to support the second floor. It is necessary to reinforce the walls both vertically and horizontally. The vertical reinforcement should consist of ¼-in. round rods, placed alternately, 1½ ins. from each face and spaced 1 ft. apart (Fig. 1). For the horizontal reinforcement, ¼-in. round rods 2 ft. apart will be satisfactory. These should be placed outside of the vertical rods near the outside face of the wall, and securely tied to them with wire ties. Around all corners, additional ¼-in. round rods, extending 3 ft. beyond the corner, should be used, placed 4½ ins. apart and running crosswise of the corner in either wall. These should be set inside of the vertical rods, near the inside face of the wall, and tied to them with wire ties. It is advisable to place two ¼-in. rods around all openings in the wall. They should be of such length that each end of the rod should extend 1 ft. beyond the open space. It is also necessary to provide a satisfactory bond between the floors and the side walls. This is best done by setting L-shaped rods in the wall. One leg of these rods should be made 1 ft. long, and the other a length equal to ¼ the distance between floor supports. The short leg should be placed end down in the wall, 2 ins. from the inside face, and in such a position that the other leg will be embedded in the slab 1 in. below the top surface of the floor. Their size and spacing should be the same as the floor-slab reinforcement.

In order to insure against dampness, in the case of solid walls, it is best to fur the walls on the inside. This can be easily done by using 1½ by 3-in. furring strips, set 2 ft. apart, and wood or metal lath. The

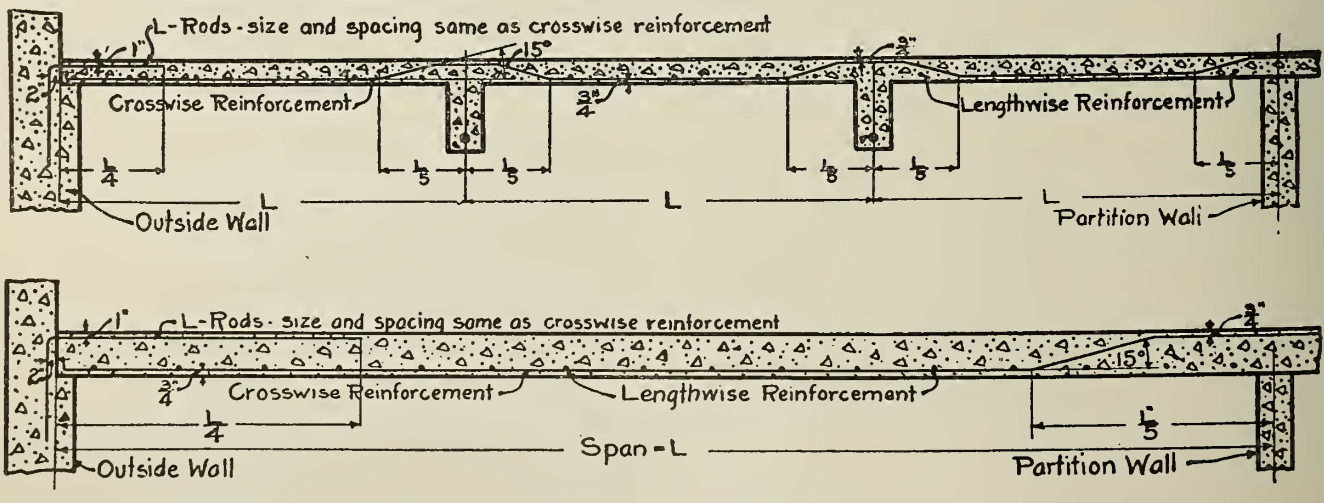

Fig. 2.—Sectional details of floor construction.

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*From data furnished the Cement World by J. F. Rhodes, Canada Cement Company.

walls are then plastered in the same manner as in ordinary construction.

In building the floors, either a flat slab or a combination of slabs and beams can be used. When a flat slab is used, its thickness and the amount of reinforcement required will depend upon the size of the room. These are given in Tables I and II.† Suppose the room is 12 by 16 ft. The width of slab will be 12 ft., and the length 16 ft. Then, in Table I, opposite 12 and under 16, the required slab thickness is found to be 5 ins. Turning to Table 11, in a similar way it is found that ⅜-in. round rods placed 4½ and 9½ ins. apart are necessary. The 4½-in. spaced rods should run crosswise of the slab, and those 9½-in. apart should run lengthwise.

For spans longer than 8 ft., the slab-and-beam type will generally be found the cheaper. This type produces a beam ceiling which will give a very pleasing effect when properly finished. The dimensions of the beams go a great way toward giving the desired result. Table III* gives the size of beam to use for different span lengths; and Table IV*, the required reinforcement for the beam. Using the same size room as in previous case, 12 by 16 ft., the floor will be designed for the beams running the narrow way and placed 4 ft. apart. Then, in Table III, for a beam 4 ft. c to c, and span of 12 ft., opposite 4 and under 12 it is found that a beam 4 ins. wide and 8 ins. deep is required. In the same way, the reinforcement is found to be one ⅞-in. round rod. The thickness of the slab necessary for the beams placed as above is now found in Table I. Opposite 4 and under 16 is 2½ in., the required thickness. In Table II the reinforcement is found to be ¼-in. round rods 7¼ ins. apart running crosswise of the slab, and 30 ins. apart lengthwise of the slab. For any other arrangement of the beams, the same method of procedure will apply.

TABLE I
Thickness of Floor-Slabs in Inches

Width of Slab in Feet	Length of Slab in Feet						
	4	6	8	10	12	14	16
4	2½	2½	2½	2½	2½	2½	2½
6		2½	2½	3	3	3	3
8			3	3½	3½	3½	3½
10				3½	4	4½	4½
12					4	4½	5
14						4½	5
16							5½

TABLE II
Spacing of Reinforcing, in Inches

Width of Slab in Feet	Length of Slab in Feet							Diameter of Rods
	4	6	8	10	12	14	16	
4	12 12	8 16	7¼ 30	7¼ 30	7¼ 30	7¼ 30	7¼ 30	¼"
6		6¼ 6¼	4¼ 7	4 30	4 30	4 30	4 30	
8			10 10	8 12½	6¾ 15	6 30	6 30	⅜"
10				7¼ 7¼	5½ 7½	5½ 9	4¼ 30	
12					5½ 5½	4¾ 6	4½ 9½	
14						4½ 4½	4 1½	
16							4 4	

NOTE—Upper figures are for short reinforcement; lower figures for long reinforcement.

The reinforcement should be installed as shown in Fig. 2. All joints in the reinforcement should come over the supports, and should be lapped 2 ft. The reinforcement should be accurately spaced and firmly held in place so that it is not moved when the concrete is deposited.

The floor finish may be concrete or wood. If a concrete finish is desired, it can be done either by working the slab smooth on top, at the time it is placed, or by leaving it rough and applying a finish coat later. If a finish coat is applied, the surface of the slab should be roughened by scrubbing with a solution composed of four parts of water to one of muriatic acid, the surface then being thoroughly cleaned with water, and the finish coat applied. The proportions of this coat should be 1 part cement to 2 parts of sand. It should be made 1-in. thick. If a wooden finish is desired, making strips 1½ by 2 in. should be placed on the concrete slab, with their edge bevelled so as to be firmly held by the concrete. They should be placed about 2 ft. apart, and the space between them filled with a cinder concrete composed of 1 part cement to 2 parts sand and 5 parts hard, clean cinders.

TABLE III
Size of Tee-Beams below Slab

Center to Center of Beams in Feet	Span of Beams in Feet						
	4	6	8	10	12	14	16
4	4 x 8	4 x 8	4 x 8	4 x 8	4 x 8	4 x 8	6 x 12
6		4 x 8	4 x 8	4 x 8	6 x 12	6 x 12	6 x 12
8			4 x 8	6 x 12	6 x 12	6 x 12	6 x 12
10				6 x 12	6 x 12	6 x 12	6 x 14
12					6 x 12	6 x 12	6 x 14
14						6 x 12	6 x 14
16							6 x 14

NOTE—First figures are width of beam; second, depth of beam below slab.

TABLE IV
Reinforcement of Tee-Beams

Center to Center of Beams in Feet	Span of Beams in Feet						
	4	6	8	10	12	14	16
4	1-½"Ø	1-½"Ø	1-⅝"Ø	1-¾"Ø	1-⅞"Ø	1-1"Ø	1-1"Ø
6		1-⅝"Ø	1-¾"Ø	1-⅞"Ø	2-⅝"Ø	2-¾"Ø	2-⅞"Ø
8			1-⅝"Ø	2-½"Ø	2-¾"Ø	2-⅞"Ø	2-1"Ø
10				2-½"Ø	2-¾"Ø	2-⅞"Ø	2-1"Ø
12					2-¾"Ø	2-⅞"Ø	2-1"Ø
14						2-⅞"Ø	2-1"Ø
16							2-1"Ø

NOTE: The sign Ø is used to designate round rod.

How to Build the Roof

The roof can be built of either the flat slab or a combination of slabs and beams. The slab thickness, size of beams, and reinforcement will be found the same way as for the floors in the tables already given. The top of the slab should be left rough so that the finish coat will have a good bond with it. It is also advisable to sprinkle stones up to ½ in. in size over the top of the slab when the concrete is placed, as these will aid in bonding the finish coat. This finish coat should be made 1-in. thick, of a mortar composed of 1 sack of cement to 2 cu. ft. of sand and 9 pounds of hydrated lime or the proper proportion of some other well-tested waterproofer. Before applying it, the slab should be well wetted with water and thoroughly cleaned. If the finish coat can be applied within an hour after the slab is placed, it is always advisable to do so. When this is done, the wetting of the slab surface may be omitted. The finish coat should be worked to a very smooth surface so that the water will run off freely. The roof can be made any desired color by adding the proper quantities of mineral pigment.

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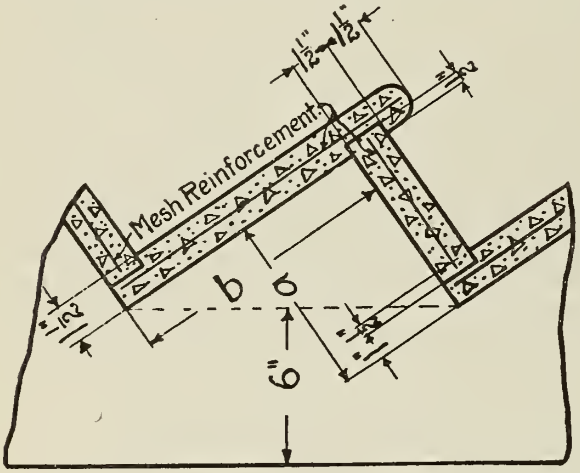
†Tables I. and II. are based on the following values: Load per sq. ft. = weight of concrete + 50 lbs. Stresses—Concrete 600 lbs.; steel 16,000 lbs. Bending moment = Wl/8.

*Tables III. and IV. are based on the same values as Tables I. and II. with the following addition: width of T-beam = 10 times the slab thickness.

Partitions and Stairways

The partitions should be not less than 4 ins. thick, and reinforced both horizontally and vertically, the same in every respect as for the outside walls.

The stairways are most easily and cheaply built by casting the stair stringers in place, the treads and risers separately, and then assembling them. For a stairway 3 ft. 6 ins. to 4 ft. wide and 9 ft. high, three stringers should be used, having a minimum depth of 6 ins., measured at right angles to the back of the stringer, and a width of 4 ins. Each stringer should be reinforced with a ½-in. round rod set 1-in. from the under side of the stringer. A rod of the same size should be left extending 1 ft. out of each floor (in a manner similar to that used for floor construction), to be embedded in each stringer when it is made, so as to get a solid connection.



The treads and risers should be made as separately molded members, as shown in Fig. 3. They should be made of a concrete composed of 1 sack of cement to 2 cu. ft. of sand and reinforced with a woven wire fabric or metal lath. The reinforcement should be set in the middle of the slab. After the treads and risers are at least two weeks old, the stairway is completed by grouting the parts in place with a cement grout composed of equal parts of cement and sand.

If columns or posts are used, they must be of such a size that their least dimension is 1-10 of their height. Thus, if a column is 10 ft. high, it should not be less than 1 ft. square. All columns should be reinforced with four 1-in. round rods, set 2 ins. in from each corner. These should be tied together with wire ties not more than 1½ ft. apart.

Chimney Construction

The chimney should be built upon a solid foundation in no way connected with that of the house. This foundation should be 2 ft. larger each way than the outside dimensions of the chimney, and 1 ft. thick. The size of the chimney will depend upon the number and size of the flues it contains, together with an allowable minimum wall thickness of 6 ins. At the bottom of the chimney, a clean-out hole should be left for each flue.

The cheapest and easiest way to build the chimney is to use tile, the size of the flue, for the inside forms which are left in place. These are used because wooden forms are very hard to build and to remove. The outside forms will consist of merely a wooden box, which can be moved as the work progresses. Care should be taken in building the chimney, that no connection is made between it and the house in any way.

If the ordinary hard wall plaster finish is desired on the inside of the building, this can easily be done by making the surface of the concrete rough where the plaster is to be applied. This is best done by using unsurfaced matched lumber for forms, and then scrubbing the concrete surface with a wire brush or stiff broom when the forms are removed. The surface should then be thoroughly wetted before plaster is applied.

The mixture of concrete to use in all parts of the building where not previously specified, should be composed of 1 sack of cement to 2 cu. ft. of sand and 4 cu. ft. of crushed stone or gravel.

Cuts in pavements in the city of Westminster, Eng., are reduced to a minimum by a method which is commented upon by George W. Tillson, consulting engineer of the Borough of Brooklyn, New York City, in his recent report on investigations of pavements in European cities. Wherever possible, Mr. Tillson says, subways, telephone and electric light lines are laid in the sidewalk area, so that the roadway will not be disturbed during construction or repairs. The most striking practice of reducing the number of street openings is the ruling that no sewer shall be smaller than 2 ft. 4 in. x 3 ft. 6 in. Workmen, therefore, can enter the sewer and tunnel from it into the house line for a connection; and in this way the surface of the street is not disturbed. This practice, Mr. Tillson points out, is particularly interesting from the fact that in America most cities will not permit tunnelling except under special conditions.

Plugging pavements to see whether specifications have been adhered to is a practice followed in Baltimore. Although there is a thoroughly competent system of inspection, both at asphalt plants and at streets, the desirability of a further check was felt recently when a great many contracts were being completed. Before final payments, therefore, it has been customary to cut out carefully a plug about 2 in. square through topping and binder, which is replaced after measurements have been made. If properly done, this is a very simple and rapid operation. No violations of specifications have thus far been disclosed.

The convention of the American Chemical Society, which was to have been held in Montreal this fall, has been cancelled owing to the war. The members were notified that the harbor and canals at Montreal were under martial law and that those with German names would be questioned very carefully at the boundary. Many of the most prominent members of the Society are of German birth or extraction. The membership is strongly represented in the municipal engineering field.

The Efficient Design of Small Waterworks Systems*

IN Massachusetts there are 215 water supply systems, and of these 152 were installed before the population of the towns they supply was 5,000, and 111 or more than half are now still supplying towns of less than 5,000. In fact, the opportunity seldom comes to design a complete system of works for a large community, the larger systems being extensions of the system designed for the small town. As there are only four towns in Massachusetts having a population of more than 3,000, which remain unsupplied with water, it is likely that, in that State at least, the problems arising in small systems will be more numerous than the problems connected with the larger systems although perhaps not so interesting to any but those immediately affected.

It has been my lot to put in a number of small waterworks plants, and it has surprised me to see how easily 10 per cent. of the cost of construction may be saved by a thorough study of the problem. I have also found that many problems over which I have worked have been solved by others who have kept the results to themselves, not because of unwillingness to part with the information, but because the matter seemed too small to be of general interest. It is with a view of encouraging the discussion of the problems connected with small waterworks installations, as well as to give a few of the results of my own experience, that this paper is presented.

Provision for Future Requirements.—The works should be designed for a long time in the future, but the design should provide for as little immediate construction as is possible except where the cost of extensions or increased capacity will be much more than the cost of doing the work in the beginning.

To build works for a long time in the future assumes a power of prophecy which most of us do not possess. It is impossible to foretell the future growth of the whole or any part of the community. The advancements in the art of water supply engineering are so rapid that portions of the plant are likely to become obsolete before they are worn out. The requirements of the public which uses the water are changing very rapidly. For these reasons it is desirable to build only for the immediate future, and to plan for additional works to be constructed as they become necessary.

Fire Protection Requirements.—The capacity of the distributing system is determined, in the case of the small town, by the fire-protection requirements solely. One good effective fire stream will use water at as great a rate as the ordinary town of 5,000 inhabitants will require for domestic purposes during the hours of maximum draft.

The quantity of water which will be drawn from the sources of supply depends upon the population to be supplied, the character of the residences supplied, the care taken to prevent leaks and other wastes and the use of water for manufacturing or mechanical purposes. It is exceedingly difficult to evaluate these factors since it is impossible accurately to forecast the industrial development or retrogression of the average small community. The population to be served depends primarily upon the growth of the community's industries. A future per capita domestic consumption of from 75 to 100 gals. per day for ordinary small towns does not seem unlikely and in the case of towns having large estates and a large area of well-kept lawns the consumption may be much larger.

Metcalf, Kuichling and Hawley, in a recent paper before the American Water Works Association, state that "the cost of the portion of the waterworks plan involved by fire protection probably constitutes from 60 to 80 per cent. of the entire cost of the physical property in the case of communities having less than 5,000 population." This is undoubtedly true except in those places where it is necessary, in order to secure water of sufficient purity for domestic purposes, to go to a large expense in obtaining it or in its purification.

In a small town it is usually necessary to depend entirely on hydrant streams without the use of steamers and it is essential, therefore, that the works, either by themselves or assisted by some outside source, should furnish both the requisite quantity of water and the proper pressure with which to fight the greatest conflagration which is likely to occur, and to do this under the most unfavorable conditions in regard to domestic consumption and quantity of water in reservoir or stand-pipe.

Fire Streams.—The standard fire stream is now considered to be that thrown by a 1⅛-in. smooth nozzle, discharging 250 gals. per minute, and it is generally considered by the insurance engineer that a hose stream which does not throw 200 gals. per minute is not a good stream. There are many cases, however, where smaller streams throwing from 150 to 175 gals. per minute would furnish reasonable protection and this is all that a town would be justified in providing in some districts. In the outlying sections of small towns, any fire which gets sufficient headway in the ordinary building so that it cannot be controlled with two streams of 150 to 175 gals. each is not likely to leave much of value if it is extinguished by using six streams. In such cases, the value of the water is chiefly in saving adjacent buildings and for this purpose even small streams are of great value. For streets in a district where the houses are small and occupy comparatively large lots with no prospect of any considerable increase in density of population, and where extensions of the mains are not likely, a hydrant which will furnish 300 gals. per minute under a suitable head to any building in the territory supposed to be covered by this hydrant, will be good fire protection. More is desirable but the advantages are not sufficiently great to warrant the expense of larger mains to secure it. In a district where the houses are nearer together but where there are no business blocks, apartment houses or other large buildings, it should be possible to get 500 or 600 gals per minute at any point. Where there are business blocks and other large buildings and where the buildings are very close together, as they frequently are in the center of a small village, it should be possible to get 1,000 gals. per minute. Where there are factories or other special fire risks, a much larger quantity may be necessary and a special study should be made of each case.

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* Abstracted by Engineering and Contracting from a paper by W. S. Johnson before the New England Waterworks Association.

Pressure and Hydrant Spacing.—The pressure required at the hydrants while the hydrants are being used should be great enough to force the water through the greatest length of hose which will be used and throw it to a sufficient height to cover any building. The hydrant spacing and the pressure should, therefore, bear some relation to each other. Table I, from E. V. French, gives the limit of a good efficient fire stream with different lengths of good rubber-lined cotton hose, with a constant pressure of 60 lbs. at the hydrant, with moderate wind. Table I also gives the corresponding amount of water which would be discharged.

Table I.—Height and Volume of One 1⅛-in. Stream Flowing From a Smooth-Bore Nozzle

100	67	250
200	59	222
300	52	206
400	44	188
500	40	178
700	33	158
1,000	25	140

Table I shows the importance of having hydrants near the buildings to be protected. Unless the hydrants are near enough to furnish water at the fire under a good pressure, the expense of large pipes and a high reservoir is largely wasted. The cost of a two-way hydrant in place is about $40 and in the ordinary distribution system about eight hydrants are required per mile of street main to keep the hydrants within 250 ft. of every building in the territory covered; so that the expense of hydrants is very small compared with the expense incurred in other parts of the system to obtain efficient fire protection. In general, hydrants should not be more than 500 feet apart in the outlying sections. In the more closely built-up sections they should be so spaced as to make it possible to get the number of streams which are considered necessary at any particular point with the use of not more than about 300 feet of hose for each stream. This figure may be modified, however, if the pressure is unusually low.

The minimum pressure desirable for good fire protection with hydrants spaced as suggested, is about 50 lbs. per square inch at the hydrants when they are in use. This pressure will give, with 300 feet of best quality hose and a 1¼-in. nozzle, a stream of 185 gals. per minute, which can be thrown to a height of 44 feet. With 200 feet of hose, the quantity thrown would be about 200 gals. per minute and the height would be increased to 50 feet. There are cases where in the higher sections of the town these pressures are almost impossible and in such places the hydrants should be so located as to require as little hose as possible. In the case of thickly built up villages, the pressure should be 60 lbs. per square inch at the hydrant when the water is being drawn at the maximum rate. This pressure will give a stream of more than 200 gals. per minute with 300 feet of hose and with 200 feet of hose will throw 222 gals. per minute to a height of about 60 feet.

Size of Mains.—The size of the mains depends entirely on the requirements determined on to give fire fighting facilities and on the head available. When these are known, the system can readily be designed. Generally, however, the head which can be secured is not fixed but can be made whatever is desired by going to additional expense and the determination of the most economical arrangemnet of height of reservoir, size of pipes and spacing of hydrants is a matter for careful study. The rule adopted in many places to put in no street main less than 6 inches in diameter in most cases works out properly but there is no excuse for it as an arbitrary rule. A short street will many times be better served with a 4-inch pipe than other streets in the same system with 6-inch mains and the money saved by using the smaller pipe could well be expended in strengthening those parts of the system which are weaker. The standard should be the quantity of water the pipe will deliver and the head under which it delivers this amount. If a 4-inch pipe will do this satisfactorily, there is no good reason why it should not be used.

The loss of head due to friction in a 6-inch pipe which has been in the ground for some time, when water is being drawn at the rate of 300 gals. per minute, is about 10 feet per 1,000 feet of length, and this figure, together with the required pressure at the hydrant of 50 lbs. per square inch should, in general, determine the allowable length of 6-inch pipe as a dead end.

The maximum desirable pressure is a matter on which there is much disagreement, but the limit is constantly being extended. If it should prove to be more economical to have a system where the pressures run up to 150 lbs., there would seem to be no good reason why this should not be done in a new system of waterworks and it would be likely to prove much more satisfactory than to maintain two levels. In 86 small towns in Massachusetts the average static pressure in the central portion of the town is 79 lbs. per square inch. Nine of these towns have pressures of less than 50 lbs.; 33 have pressures of from 50 to 75 lbs.; 31, from 75 to 100 lbs. ,and in 13 the pressure is more than 100 lbs.

Pumping Engines.—The development of the oil and gasoline engine has done much to make waterworks systems for small places financially possible. When the only available pumping machinery was the steam pump, the cost of installation of pumps and boilers, the cost of the pumping station to house them and the cost of maintaining the plant made waterworks practically out of the question unless a gravity supply could be secured. With the new form of engine, however, the conditions are quite different. The cost of the machinery has been greatly reduced, the cost of the station is much less and the cost of operating is reduced to a minimum on account of the fact that with oil or gasoline there is no consumption of fuel except while the work is being done, while with a steam plant a large proportion of the coal is used in banking the fires and getting up steam. Electricity is also becoming an important factor in connection with small pumping plants, although the cost of current is so great (in New England) that there are few places where oil or gasoline are not more economical, except for auxiliary plants used only occasionally.

Pumps should usually be designed for the greatest economy in doing the work which they are called upon to do regularly in supplying the domestic needs of the town, without regard to their use for fire protection purposes. It is seldom feasible in the small system to have pumps of sufficient capacity to be of very great value in case of fire, and dependence for fire protection should be placed on water stored in a reservoir or large stand-pipe or tank, or on some connection with factory pumps through which a large supply of water can be quickly secured. With increased size of pumps it is necessary to have a larger force main, a larger suction pipe, more wells, if the supply is taken from driven wells; in fact, a considerable portion of the plant must be increased in size and made more expensive in order to operate large pumps. Large pumps are somewhat more efficient than small ones and if an attendant remains at the station while the pumps are in operation there is a saving in the shorter hours required with the large pump. With the oil engine, however, or with electricity, constant attendance is unnecessary, especially in the case of the smaller plants.

Pumping machinery should always be provided in duplicate, and works, although designed to run most economically when one unit is in operation, can be operated, if necessary, at double capacity with a somewhat reduced efficiency. A plant designed for a community which will use from 100,000 to 150,000 gals. per day, should generally have a capacity of about 250 gals. per minute for each unit. This would mean the operation of one of the pumps for from six to ten hours each day. Such a plant would give two large fire streams in case of fire by starting both of the pumps. Many pumping plants are undoubtedly of too large capacity for economy and the tendency in recent years has been to make them smaller, especially when the power used is some form of internal combustion engine.

Distributing Reservoir.—The design of the distributing reservoir is affected chiefly by the topography, the requirements for fire protection and by facilities for pumping. In a much less degree it is affected by the consumption of water. The effect of the topography upon the design is generally to change the reservoir from what is desirable to what is practicable. In a comparatively flat community it is practically impossible to store as much water at so great an elevation as is desirable and in such cases the distributing reservoir must be cut down and other portions of the system must be designed to do the work which should properly be done by the distributing reservoir.

When the topography is such that it is feasible to build a reservoir of any desired size and any height, the design is dependent almost entirely upon the requirements for fire protection. Generally it is found that the desirable statis pressure from the reservoir point where there is likely to be the greatest demand for water is from 80 to 100 lbs., depending to a large extent upon the distance from the reservoir to the center of distribution. The reservoir should be, if practicable, large enough to hold at the required elevation, in addition to the domestic supply for 24 hours, a sufficient quantity of water with which to fight any fire which is likely to occur. A fire in the built up portion of a village may take about 1,000 gals. per minute or 60,000 gals. per hour. In general, the time during which this quantity will be required will not be more than from two to four hours. Applying this rule to the ordinary town with no large fire risks, the capacity of the reservoir or standpipe should be from 300,000 to 400,000 gals.

Pipe Thickness.—The part of the design in which theory plays the smallest part and in which even experience is likely to count for little is in the determination of the thickness and weight of cast iron mains. The static pressure which pipes have to withstand and the breaking strength of the cast iron are the only elements in determining the proper thickness of the pipes which are even approximately known, and determining the thickness from these elements alone would give pipes of about the thickness of cardboard.

The formula used by the New England Waterworks Association is:

$$t = \frac{pr}{1/5\ (16{,}500)} + \frac{p'r}{1/5\ (16{,}500)} + 0.25$$

where t is the thickness of the shell in inches; r is the radius of the pipe; p, the static pressure in pounds per square inch; p', an assumed water hammer in pounds per square inch; 16,500 is the breaking strength of cast iron; and 5 is a factor of safety.

The chief uncertainties in the determination of the proper thickness of pipes are the water hammer, the effect of corrosion, the possibility of breakages in handling, the strains due to imperfect foundations or unequal settlement and the eccentricity of castings and other imperfections in the pipe. There is no reason why the water hammer in a small system should not be kept below the figures ordinarily used in the formula. There are few, if any, authentic cases where corrosion of a cast iron pipe has caused its failure. In fact, if a pipe has been in the ground long enough to corrode, it seldom fails from any cause. The strains due to imperfect foundation and settlement, in the case of small pipes, can be neglected if proper precautions are taken during construction. The difficulties due to imperfections in the casting and to the handling of thin pipes are the most serious and to overcome these is the duty of the founders. That they will be overcome, if the engineers insist on light pipe, there is no doubt, for already much has been done along these lines; the cost per ton may be somewhat increased if lighter pipes are used, but this increased cost will be nothing like the saving accomplished by the use of the lighter pipe.

In my own practice, I have put in many miles of Class C pipe where the pressures run up to 115 lbs. per square inch and have never known of a failure which would have been prevented by using thicker pipe.

Depth of Cover for Pipe Lines.—The depth to which street mains should be laid has been investigated by a special committee of New England Waterworks Association, see report presented at November, 1909, meeting, and the experience of the cold winter of 1911-12 has given valuable experience to those who have had charge of waterworks. The depth determined on affects the cost of the works materially, especially if rock is encountered, and if it is safe to reduce the depth it certainly should be done.

Theoretically, street mains might be laid at different depths in indifferent soils, being a foot nearer the surface in clay than in gravel, but in the average New England town there are so many soils that it is not wise to make any distinction. The only discrimination which it would appear safe to make is in the case of places where the ground water always stands near the surface, where the pipes may be laid in shallow trenches. The freezing of the pipes is such a serious matter that it would seem to be unwise to take any chances in an attempt to save money on trench excavation. The best practice seems to be, for a climate like that of Massachusetts, to have the center of the pipe from 4.75 to 5 ft. beneath the surface.

High Standard of Exhibits at Toronto

Great National Show at the Queen City Marked by Many Advances in the Displays of the Constructional Interests

ALL things considered, the Thirty-Sixth Annual Exhibition in connection with the Canadian National Exhibition Association, which opened at Toronto on August 29, has proved most successful. The display generally reached a very high standard and the exhibits representative of the industrial enterprise of the Dominion were creditable alike to the manufacturers and to the Exhibition executive. It is hardly necessary to expatiate upon the part that the Canadian National Exhibition plays in the development of the country, in bringing all sections of the people together on a common basis and enabling each to profit by the results of industrial and business enterprise.

The exhibits identified with the field of the Contract Record provided exceptional interest for exhibition visitors. Below we refer briefly to a number of the more prominent exhibits.

The Hoidge Marble Company, dealers in domestic and foreign marbles, exhibited some excellent specimens of their marbles in the Government Building.

W. D. Beath & Sons, Toronto.—This company had an important outside exhibit which comprised an extensive line of switches and overhead tracks as well as a variety of derricks, both of which are hand-power operated.

B-O-T Manufacturing Company, Limited, Toronto.—This firm exhibited their B-O-T guaranteed water closet outfits, special attention being drawn to the construction of the lock-dovetail where each tenon of the joint is a real wedge.

The Dominion Sewer Pipe Company, Swansea, Ont.—This firm had a well-arranged display of sewer pipes. They also exhibited other well-known lines of chimney tops, wall coping, culverts and inverts which attracted favorable notice.

The Consumers Gas Company, Toronto.—Lighting fixtures are always a strong element of attraction and this year's exhibit of the Consumers Gas Company drew large crowds to examine the handsome display of lighting fixtures, which they did with much interest.

The Dominion Belting Company, Limited, Hamilton, Ont.—This firm showed a full line of "Maple Leaf" products, which embraced an attractive display of Maple Leaf brand stitched cotton duck belting. "Crescent" belt fastening was also demonstrated at this booth.

The Wm. Peace Company, Limited, Hamilton, Ont.—Had an attractive display of the "Peace" patent improved metal weather strip for windows and doors. The metal is claimed to be both wind and dust proof and is made in four different products, zinc, brass, copper and bronze.

The H. Mueller Manufacturing Company, Limited, Sarnia, Ont.—This firm had an interesting display of plumbing, waterworks and gas appliances. Amongst the principal lines shown were the Mueller water meter testers, which are made complete in two sizes, also the tester tanks, made specially for use with Mueller water meter testers and the Mueller truck for moving large meters to and from a tester. Other lines include reducing and regulating valves and pump governors. Their Colonial self-closing faucets were a no less interesting feature of the exhibit.

A. Ramsay & Son Company, Montreal.—Had an interesting display of paints for exterior and interior work. The Ramsay's white lead for exterior work is a line which the firm emphasizes to contractors on the ground that it has been proved to withstand successfully the test of time.

R. A. Lister & Company, Limited, Toronto.—Had an interesting exhibit of electric generating plants which included their direct running, automatic or storage battery sets, particularly the 6 kw. generating set. Many of these latter are in use in connection with contractors' plants.

The Bateman-Wilkinson Company, Limited, Toronto—Drag and wheel scrapers, road plows and contractors' barrows, filled a conspicuous place in this firm's exhibit of contractors' supplies. The collection, which also included several other lines, made a particularly noteworthy exhibit.

The Waterous Engine Works Company, Limited, Brantford, Ont.—A special feature of this firm's exhibit this year were their steam road rollers which are so well-known in every part of the country where they have been introduced. A line in their "trouble-proof" pumps was also shown.

The Standard Ideal Company, Limited, Port Hope, Ont.—Had an interesting display of bathroom and toilet fixtures, including the Victor one-piece bath, enamelled all over. Amongst the high-class buildings fitted with this type of bath is the Vancouver Hotel, built for the Canadian Pacific Railway.

The John Deere Plow Company of Welland, Limited.—The exhibit of this firm included a number of drag scrapers, road plows and contractors' barrows. The popular new short coupled Watson dump wagon occupied a prominent place in the exhibit and drew much favorable comment from interested visitors.

The Canadian Fairbanks-Morse Company, Limited, Toronto.—Displayed types of their well-known gasoline engines such as are used with their M-C rail track paver. These engines are specially built for operating the standard mixers and their many commendable features were the subject of much attention.

The Standard Sanitary Manufacturing Company of Canada, Limited, Toronto.—This firm's booth in the Process Building was replete with plumbing fixtures in great variety, also sanitary appliances. In regard to the latter, a couple of complete bathrooms and toilets were shown. These proved of great interest to many visitors.

The Pedlar People of Oshawa, Ont.—A strong line of sheet metal products from their factory, claimed to be the largest of its kind in the British Empire, was exhibited by the Pedlar People of Oshawa. Their "Perfect" steel and metal shingles came in for special notice and their corrugated steel sheets for roofing and siding formed an interesting display. A model dwelling, illustrating the high value of the firm's products, combined with the comparative inexpensiveness of construction, was exhibited on the grounds, its general attractive appearance winning universal commendation. Pedlar's "Perfect" culverts, made of anti-corrosive "Toncan" metal, also form part of this interesting exhibit.

The Jas. Morrison Brass Manufacturing Company, Limited, Toronto.—Exhibited their J-M-T standard reducing valves for reducing high pressure steam to the low pressure required for such apparatus as is used in heating, dyeing, boiling and drying. The exhibit also included recording pressure gauges and corporation service brass works.

The Dunlop Tire & Rubber Goods Company, Toronto.—An attractive booth in the Transportation Building was that of the Dunlop Company, whose exhibit of all kinds of fire hose and rubber tires was commendable. The exhibit included the well-known traction tread clincher tires, also tires suitable for heavy motor trucks.

Mackintosh Hutchinson, Toronto.—The exhibit at this booth was the Hutchinson Combination woodworker, a machine which is claimed to be an important labor and money saver for builders and contractors. An interesting feature of the exhibit was a portable contractors' saw, which was demonstrated to the satisfaction of many visitors.

The Dennis Wire & Iron Works, Limited, London, Ont.—Dennisteel products made a commanding display in the Process Building. Lockers, bins, racks, tables and benches, partitions, etc., of steel construction attracted much attention, the advantage of unit construction being demonstrated to visitors. This firm also have an important line in fire escapes.

The Star Expansion Bolt Company.—Had an interesting display of Sebco products, including Sebco expansion bolts, single and double types, chair expansion bolt drills, and the Star Toggle bolt. Star drills, which are especially adapted for drilling clean-cut holes for the Star Toggle bolt, were also on display. Mr. H. F. McIntosh, Toronto, is the sales agent.

Batts Limited, West Toronto.—As manufacturers of staved columns, veneered and pine doors, newel posts, trim and interior fittings, etc., Batts Limited are well-known in the building and contracting world. The firm had a very pleasing display of stave columns, showing lock joint pilasters, doors of all kinds, besides attractive examples of panelling and other interior work.

The Ontario Marble Quarries, Limited, Bancroft, Ont.—Among the exhibits of Ontario's mineral wealth which occupied a place in the Government Building not the least conspicuous was the display of marbles made by this well-known firm. The attractive combination in the coloring of the different marbles was demonstrated in a model house front erected in the building.

The Asbestos Manufacturing Company, Limited, Montreal.—The exhibit of this well-known firm comprised the popular asbestos cement shingles, cement sheathing, Asbestoslate and Linasbestos building board. This building board, which is claimed by the makers to be the only absolutely fireproof cheap building board which can be used as a finished surface, is a composition of asbestos and Portland cement, of cement color with a pinkish tinge. A handsome residence was exhibited on the grounds by way of demonstrating the combination of artistic beauty and practical utility of the material, when judiciously used in the interior. Among the prominent buildings to which Asbestoslate has been applied as a roofing material in Toronto are the armoury, University avenue, and the Government Building, Exhibition grounds. Many high-class residences have also been roofed with Asbestoslate and Asbestos Cement shingles.

The Cleveland Pneumatic Tool Company of Canada, Toronto.—An interesting display of air tools, which included air drills of the ball-bearing type, reversible and non-reversible, was exhibited by this firm. Several samples of air hose couplings of the Bowes automatic type occupied an important place at the booth, also the "Neverslip" clamps which connect hose to couplings.

Nash Temperature Control, Limited, Toronto.—This firm demonstrated the Nash system of automatic temperature control by compressed air or vacuum. The Nash system is claimed to be applicable to every form of ventilation, never allowing a room to become too hot or too cold. It is a simple temperature control, being only 6 ins. over all and is claimed to be indestructible.

The Tuec Company, Toronto.—This firm demonstrated the Tuec Stationary Vacuum cleaner, the outstanding qualities of which are claimed to be simplicity, economy and durability. The demonstration naturally drew large numbers of interested spectators who were anxious to see the Tuec machine in motion. The efficiency and dependability of this machine is too widely known to call for commendation here.

The Consolidated Optical Company, Toronto.—This firm are the manufacturers of transits and levels as used by the engineer, surveyor, architect and builder. Their line of Consol surveying and engineering transits and levels attracted particular notice. The 14-in. Consol engineer's dumpy level, also the Wye level were also exhibited. The products of this firm are made in Canada. The T. Eaton Company, Limited, Toronto, are the Sales Agents.

The Prest-O-Lite Company, Inc., Indianapolis, Ind., the Canadian main office of which is in Toronto, exhibited their high-class oxy-acetylene process which is a widely known portable welding outfit. Some of the main characteristics claimed for the Prest-O-Welder are its portability, economy, convenience, safety, ease of control and durability. The company also exhibited the Prest-O-Flare lamp, a portable outdoor light for contractors, etc., which attracted special notice.

Canadian Independent Telephone Company, Toronto.—The Lorimer Presto-Phone system, an automatic telephone system for inside service, was exhibited by this company and included the Presto-Phone switch. The main advantages claimed for this system are compactness of switchboard and telephone, simplicity of operation, and absolute secrecy of service. The system is claimed to be especially suited for manufacturing plants, municipal and administration buildings, as well as hospitals and colleges.

Automatic Fire Detectors, Limited, Toronto.—The importance of detecting fire in its infancy has been realized by this firm, whose exhibit and demonstration came in for much attention. The Automatic Fire Detector consists of a small circular white enamelled wooden base about 4 ins. in diameter, on which is a neat nickel frame. Inside the frame is a sensitive metal spring. It is very simple in construction and so sensitive in its application that it should prove of immense service to architects and contractors.

The Sawyer-Massey Company, Limited, Hamilton, Ont.—Some excellent types of road machinery and contractors' supplies were shown at this booth. Their new model solid steel crusher has absorbed a good deal of attention on the part of contractors, as also has their No. 10½ crusher with roller-bearing truck. These contractors' requisites are manufactured in twelve different sizes to suit the varying requirements.

Sasgen Derrick Company, Toronto.—A wide range of contractors' derricks. The exhibit demonstrated a number of noteworthy improvements over the old style in the various makes. Sasgen circle swing steel derricks, double boom wheelbarrow derricks and Sasgen stiff legged derricks came in for particular attention as embodying lines of increasing popularity in the constructional field.

The Page Wire Fence Company, Limited, Walkerville, Ont.—This company had an interesting exhibit of concrete wire reinforcement for concrete road pavement, bridges and building floors. The firm are the originators of Page wire reinforcement in flat sheets which is claimed to be coming into universal use wherever introduced. The standard mesh is supplied in different sizes for road pavement and also for bridges and building floors.

The Black Building Supply Company, Limited, Toronto.—Some very handsome terra cotta work, manufactured by the Northwestern Terra Cotta Company, Chicago, adorned the walls of this exhibit. Examples of architectural terra cotta shown included various grades of vitreous face brick including Hy-tex. One of the special lines of the company this year is the Covert damper and the Underwriters fire scrupper—a very heavy and up-to-date type. Salt glazed tile, with which the floor of the booth was paved, is another of the company's special lines.

Geo. B. Meadows, Toronto, Iron, Wire and Brass Works, Limited.—This company had a very attractive booth in which they exhibited various samples of their ornamental iron, bronze and brass works and metal lockers. An interesting feature of the exhibit was a beautifully executed panel as an example of their bronze work, also a spiral stairway. The Meadows metal lockers, adaptable to all classes of buildings and fitted with the new Sure Grip triple locking device, occupied an advantageous place in the market.

The Bishopric Wall Board Company, Limited, Ottawa, Ont.—Had an excellent showing of lath and stucco boards for interior and exterior use. This wall board is claimed to be equally suitable for schools, residences and stores, being non-inflammable, weatherproof and comparatively inexpensive. The well-known Bishopric sheathing has reached a noteworthy place in the equipment of contractors, mainly because of the ease with which it can be applied and also because of the excellent panelling effects where the material is used in residences.

The Stromberg-Carlson Telephone Manufacturing Company, Toronto.—Demonstrated the practical value of the Inter-Comm-Phone system—desk type and wall type. By this system the company claim that three distinct conversations may be carried on over a six-station Inter-Comm-Phone without interfering with each other, owing to a separate pair of wires going to each station from every other station. The company have installed the system with success in many large factory and other buildings, including that of the Office Specialty Manufacturing Company, Newmarket, Ont.

The Brantford Roofing Company, Limited, Brantford, Ont.—Had an unique exhibit of their well-known roofings. In addition to their well-known ready roofings, Climax sheeting, insulating paper and building papers of all kinds were also shown. The Brantford Asphalt sheet shingles were an interesting display and received the favorable notice of a large number of exhibition visitors. The firm's paints included the "Roof-Leak" paint, also the Superior roof coating, which is applicable to cement, metal, steel and woodwork. It should be mentioned that asphalt shingles are one of the latest products of the Brantford Roofing Company. They are manufactured in three different colors, red, green and white, and several important buildings are at present being covered with the material.

The Northern Electric & Manufacturing Company, successors to the Imperial Wire & Cable Company—Had an exhibit of much interest to engineers and architects. It included the "Imperial High-grade" rubber insulated wire. The company have standardized three grades of rubber compound for rubber insulating conductors—"Adanac Imperial," "High-grade" and "30 per cent. Para." These wires are made to exceed the requirements of the National Board of Fire Underwriters, and are used principally for wiring buildings. Amongst the latter which have been wired with this firm's material are the Ritz-Carlton Hotel, Montreal, the Chateau Laurier and the Union Station, Ottawa, the Electric Railway Chambers, Winnipeg, and the Parliament Buildings, Regina. The Northern Electric Inter-Phone, the key-note of which is claimed to be simplicity of operation, was also demonstrated at this booth.

Clamps for Splicing Reinforcement

THE idea still seems to be prevalent in some localities that satisfactory splices of reinforcing bars in tension can be made by the use of clamps, thereby reducing the amount of lap (excess material) required to a minimum, in spite of the fact that tests have shown that such splices are not capable of properly developing the bars, no matter what the style of clamp. The only way to develop the strength of reinforcing bars is to lap them a sufficient distance so that the stress may be transferred from one to the other by bond, for beam tests show that the slip of reinforcing bars in tension marks the beginning of the beam failure.

Tests on bars spliced with clamps of various types show that an amount of slip sufficient to destroy the bond between concrete and steel takes place in practically all cases before the clamps come into action, and their purpose is therefore defeated.

In many cases where long bars are required and splicing must be resorted to, it is advantageous to clamp the ends of bars to be spliced, in order to facilitate holding them in position. When this is done, the bars should be lapped a sufficient distance to develop their strength in bond, no reliance being placed on the clamps to transfer stress. The bars should also be separated at least two diameters, centre to centre, at the splices, in order to allow the concrete to completely envelop the bars.

Canada the Chief Source of Asbestos Supply

CANADA is the world's chief source of supply of asbestos. Activity in the production of asbestos in Canada in 1913 was confined to the districts of Black Lake, Thetford and Danville in Quebec. None of the quarries formerly operated at East Broughton were worked, although small shipments were made by one firm from stock. The output and shipments in 1913 exceeded those of all previous years, the increase in sales over 1912 being 22.75 per cent. The total output in 1913 was 132,564 tons, as against 102,759 tons in 1912, an increase of 29,805 tons, or 29 per cent. The sales and shipments of asbestos fibre in 1913 were 136,951 tons, valued at $3,830,909, or an average of $27.97 per ton, as against sales in 1912 of 111,561 tons, valued at $3,117,572, or an average of $27,95. Stock on hand on December 31st, 1913, was reported as 20,786 tons, as compared with stocks of 23,288 tons at the beginning of the year. The exports of asbestos from Canada during the eleven months ending February, 1914, were 94,926 tons, value $2,579,448.

The Province of Quebec contains the principal asbestos-producing areas of Canada. The present workable deposits lie scattered through the great serpentine range which strikes through the townships of Broughton, Thetford and Coleraine. The total length of this belt is 23 miles, with a width varying from 100 feet in the extreme easterly part to 6,000 feet in the Mock Lake area. The principal deposits occur at Thetford, Black Lake, Danville, and East Broughton, the first two being the most important. The deposits are worked by open quarrying, the long-fibred asbestos of the larger veins being easily separated out, while the smaller material is carefully cobbed. This separation was at first accomplished entirely by hand, but mechanical treatment has been gradually introduced and perfected, until now large mills are in operation in which the rock is broken and crushed in various ways, and the fiberized asbestos is taken up from screens by suction fans, and blown into collectors or settling chambers. The annual production is now over 100,000 tons, valued at upward of $3,000,000. It includes a wide variety of grades, from the long-fibred crude asbestos, valued at $300 a ton, down to the shortest mill fibre, valued at only $2 or $3 a ton, and "asbestic sand," used for wall-plaster, and valued at from 75c. to $1½ a ton.

Puddling or Ramming Concrete After Placing

WHEN concrete first came into use, dry mixtures were used almost exclusively, and, in order to obtain compact and dense concrete, considerable tamping was necessary. Times have changed, however; and nowadays nearly all concrete mixed for placing in forms, except that placed under the direction of students of the "old school," is mixed wet, and ramming or tamping dispensed with entirely, the mixture being churned or puddled just enough to remove the entrained air.

Still, we occasionally hear of some superintendent, inspector, or engineer in charge of construction work, demanding that concrete, even if it is wet, be placed in six-inch layers and thoroughly tamped. With such concrete, tamping defeats its very purpose, for the top will be flooded with water mixed with pure cement, thus robbing the concrete of cement and reducing its strength, and making the concrete of a non-uniform mixture by forcing the large aggregate to the bottom. A wet mixture of concrete such as can be spouted by gravity should never be tamped or rammed with heavy tools; stirring, spading, or puddling with forks, spades, or rods is all that is required to allow the entrained air to escape and the voids to be filled. When wet concrete is used, it is also very important to see that the concrete be placed or poured in such a way as to prevent the formation of air-pockets, thus reducing the puddling or spading necessary.

Even with "dry" concrete there are dangers to be incurred by "too much tamping"—that is, by forcing the stone to the bottom and weakening the concrete by disturbing it after setting has begun. As in most work, there is a happy medium which must be struck in order to obtain the best results in ramming or puddling concrete.

When wet concrete is used, the rate of progress of the work is much more rapid than when dry concrete is used, since it can be placed in thicker layers and requires less attention in the matter of puddling if carefully placed. Wet concrete, then, it can be said, is the result of the general tendency toward the use of more economical methods in concrete construction work.

Something About Advertising

The failure of a trial advertisement has set more business men against advertising than any other factor in publicity. This is a pity when the indefiniteness of a trial advertisement is considered. A trial advertisement represents low-water mark—absolute bottom. It is not decisive. It has no more value as evidence than a first meeting with an individual who afterwards becomes your friend. Of all the advertisements in a long campaign, the first ad is the worst, though it is written by an adept. If it is written by a novice in advertising, that novice will never write a weaker one. It is like the first discord struck out of the piano by a beginner. If a student becomes disgusted with such an initial effort he will never get farther, and if a merchant abandons his advertising intentions because the first advertisement was unremunerative, he will never get farther. The first attempt at anything is valuable only as an educator. Advertising is like seed sown, it's got to have time to grow before you can reap the harvest.

If a paper, after careful examination, impresses you at all favorably, it's worth giving a fair trial. In no case should a trial ad be inserted for less than six months. If the paper is going to be a paying investment for you, it will begin to show results by that time.

There is a big difference between feeding a cow just enough to keep her alive, and feeding her enough to create a profit.

The same is true about advertising. Nine times out of ten a small advertisement inserted one or two times is simply a waste of money, while the same advertisement inserted for six or more months would have become a paying investment.

The city of Montreal has made a gratifying record in building construction this year, despite the financial depression and the war. From January 1st to August 31st permits were issued to the value of $12,158 000. This compares with $13,817,000 for the corresponding period of last year.

Clay and Shale Deposits of the Western Provinces

VALUABLE investigations of the clay and shale deposits of Western Canada, made by Dr. Heinrich Ries in company with Mr. Jos. Keele, are reported in a Memoir issued by the Geological Survey of the Department of Mines. The report, which is well illustrated, discusses in detail the physical properties of the clays found in the various districts. Dr. Ries speaks optimistically of the possibilities for the clay-worker in the West and says that this work has demonstrated the existence of a variety of clays in the several Western provinces of the Dominion. He reports:

"That there is a growing demand for different kinds of burned clay wares, will be admitted by all who are familiar with the situation in the region under discussion. Brick, both common and pressed, fireproofing, and sewer pipe are among the products most desired, but the larger cities like Winnipeg and Vancouver, are also calling for not a little terra cotta.

"The work carried on by the Geological Survey has demonstrated that the clays and shales found in the western provinces can be used for a variety of purposes, but it will be noticed that in no case has it been claimed that the clay or shale can be used for all sorts of purposes.

"That a lucrative field is open to the conservative investor and competent manufacturer, goes without saying, but here as in any other country, failure often awaits the individual or company that goes ahead blindly, without first studying the situation. There is no doubt that in several cases plants have been started apparently for the purpose of selling stock, and claims are made that the material is good for making this, that, and the other kind of product, although there appears to be no evidence to back the statement.

"Two facts are true, viz.: (1) that owing to the scarcity of local clay products, some inferior material is sometimes accepted in the market; and, (2) that on account of local conditions, such as high prices obtainable for product, it is often possible to operate deposits which it would not pay to work in other regions which are more thickly settled and easier of access, by competing concerns.

"Before a new plant is started, the ground should be carefully tested to make sure that a sufficient quantity of clay exists. This should be followed by a thorough and proper test of the material, made on samples that were properly taken.

"Last and not least, comes the selection of the necessary machinery for preparing, moulding, and drying the clay.

"If all these steps are carried out carefully, thoroughly, and competently, there should be no excuse for failure."

The report contains in the following summarized form the results of the several seasons' field work. The occurrences are grouped first geographically and then geologically.

GREAT PLAIN REGIONS

In this region between Winnipeg and the Rocky mountains, we have surface clays and shale formations. The former are the most widely used but the latter are the more valuable commercially.

Surface Clays

Those surface clays used for brick-making purposes in the Great Plains region include: (1) Lake clays; (2) river-terrace or flood-plain deposits; and (3) delta deposits.

The lake clays are irregularly distributed, of variable character, and in some cases resemble some of the representatives of the other types in their physical properties. The dark grey clay underlying the brick clay in the Red River valley is of this type, and is avoided by the brick makers around Winnipeg as it cracks in burning.

The more sandy lake clays, however, such as those around Red Deer and Prince Arthur, are used with satisfaction.

The flood-plain deposits are employed around Winnipeg and Edmonton.

In general the surface clays are silty or sandy, and often calcareous to such a degree that they give a cream-coloured product. Where not too sandy and lean they work well in a stiff-mud machine and can be utilized not only for common brick, but also for pressed brick, drain tile, and partition tile; but common brick is the chief product. Some of them have to be carefully dried to prevent cracking.

Winnipeg, Portage la Prairie, Saskatoon, and Edmonton are important producing localities.

In many districts these surface clays are the only available materials for brickmaking, and have to be used; in others they are sometimes chosen when better materials are at hand, simply because they work a little easier.

Shales

The shale formations that are available for clay working include the Niobrara, Pierre, Belly River, Edmonton, Laramie, and Miocene.

The Niobrara shale is found in both Manitoba and Saskatchewan. In southern Manitoba, near Leary, the shale is very plastic, and somewhat carbonaceous, but it has been used successfully for dry-press brick. To the northward along the eastern face of the Porcupine hills the Niobrara is found in quantities, but is often too carbonaceous to be used alone, although it could probably be mixed with other shales.

In Saskatchewan, along Lots lake north of Regina there are also extensive exposures of the Niobrara which could be used for pressed brick, and tests of the shale from this region are given to Memoir 25 now in press.

Tests made in the laboratory also developed the fact that a mixture of Niobrara and Pierre shale can be employed to make sewer pipe.

The Pierre formation, which is composed almost wholly of shales, occupies the summits of all the higher land in the western part of the Province of Manitoba.

The upper portion of the Pierre contains a considerable thickness of hard, light-grey, fine-grained shale, the lower portion being made up of softer dark grey shale, which contains crystals of selenite, and nodules of clay iron stone. It is the former that is of more value to the clay worker.

The Pierre shales are found outcropping at a number of localities in the Province of Manitoba, but about the only point where an attempt has been made to utilize them is at LaRiviere, Manitoba, where they have been worked for pressed brick.

In order to get a good product from the Pierre shale, it should be finely ground and if possible mixed with a little plastic clay, as the shale alone does not develop very much plasticity nor burn to a dense body. With care it can be used in pressed-brick manufacture. The material is not a fireclay, as often thought to be, although it sometimes shows a fusing point of cone 10 or 12.

The Belly River formation underlies a large area of the plains (See Geological Map, Memoir 24), but outcrops are scarce owing to the heavy mantle of Pleistocene material, so that it is only well exposed as a rule in the cut banks of the larger rivers like the Belly and South Saskatchewan. But even there the sections are sometimes not continuous owing to the irregular upper surface of the formation.

There is no doubt but that this is an important shale formation, and one which contains strong possibilities. The characters of the shales may be summed up as follows: (1)

usually red burning; (2) often very plastic; (3) occurrence somewhat lense-like, but lenses sometimes of considerable size; (4) fusion point not as a rule above cone 5 or 6; (5) many work smoothly through a die; (6) they usually have to be carefully dried to prevent cracking.

These shales form an important source of supply for making common brick, pressed brick, and fireproofing. More recently certain ones have been used for common earthenware.

At present they are worked only in the region around Medicine Hat, but they are accessible at other points, and the two preceding reports as well as the present one, contain tests of these shales from Bow Island, Taber, Lethbridge and vicinity, Milk Creek, near Pincher, etc.

The Laramie formation, proper, underlies a small triangular area in southern Manitoba in the Turtle Mountain region.

Farther west a second but much larger triangular area is found in southern Saskatchewan. The base of this triangle forms the southern boundary of this Province as far west as the Wood Mountain district, which is included in it.

From the apex of the triangle a narrow belt extends north-westward to a little beyond the main line of the Canadian Pacific Railway west of Moose Jaw. This area includes the Souris coal field,[1] and the Dirt Hills.

The Laramie formation has been found to contain two very contrasted types of clay deposits.

In the Souris coal field we have a number of shale deposits associated with the coal seams. These shales burn to a red or sometimes buff colour,[2] and are interbedded with coals and sandstones. Practically no attempt appears to have been made to utilize them except at Estevan.

The second type of clay is that found in the Dirt hills south of Moose Jaw. Here we have deposits of white and grey clays of truly refractory character, and associated with them are clay shales of lower refractoriness.

By using proper mixtures of the different beds these materials can be used for making firebrick, pressed brick, sewer pipe, and stoneware. The deposits represent one of the greatest clay assets of the Great Plains area, and with the construction of the Canadian Northern, south from Moose Jaw, and the Lethbridge-Moose Jaw branch of the Canadian Pacific Railway, the clays of this area become easily accessible.

Next in importance to the Laramie formation is the Edmonton formation. This underlies a belt of varying width extending from the centre of the Province of Alberta, and also extending westward from Edmonton towards the mountains.

In Alberta it is divided into two parts: (1) A coal-bearing member known as the Edmonton and likely to be the more productive of shales, and (2) a heavy sandstone formation known as the Paskapoo.

The first forms a trough, which is filled along its centre by the latter. This trough widens to the north, and also flattens, exposing a larger area of the Edmonton series than in the southern part.

The shales are found with the coal seams around Edmonton, and also up the Saskatchewan river south of there.

They are likewise well exposed to the west of Edmonton along the Pembina and Lobstick rivers, and on Wolf Creek still farther west.

Those around Edmonton as a rule give trouble in moulding and drying, and are not satisfactory, but those found to the westward at the points mentioned are well worth working, since they represent materials that can be used for common, pressed, and paving brick, drain tile, fireproofing and probably in some cases sewer pipe.

Shale exposures should also be looked for on the Red Deer river within the limits underlain by the formation, and on the Bow river near Crowfoot crossing.

A narrow belt of the Edmonton formation occurs along the foothills, and passes west of Cowley on the Crows Nest branch of the Canadian Pacific Railway, and west of Cochrane on the main line of the same road.

The Tertiary formations overlie the Edmonton series and form a broad belt extending from somewhat north of the Grand Trunk Pacific west of Edmonton, southward almost to the International Boundary.

The formation consists of shales and sandstones often alternating in rapid succession. Outcrops are scarce, as the formation is heavily and extensively covered by Pleistocene sands and gravels.

It includes the shale areas examined at Red Deer, Calgary, Sandstone, and Pincher Creek near Pincher.

Tests of the shales collected from these areas in 1910 and 1911 have shown: (1) that the formation carries a number of good shale deposits; (2) that the quantity of interbedded sandstone layers varies from point to point; (3) that different beds of the shale vary in their refractoriness, the fusion point of the different ones ranging from cone 3 to 15 ;(4) that they are usually red burning.

This is an important shale formation, and it carries material suitable for making common or pressed brick, fireproofing, and in some cases even sewer pipe. Before a plant is located, however, the property should be carefully prospected and the material properly tested.

The formation is often covered by gravel, so that shale outcrops are scarce, but in many instances the material lies at no great distance below the surface.

MOUNTAIN REGION

This includes the region bordered on the east by the Great Plains, and on the west by the Coast Range, and does not contain such extensive clay resources as the Great Plains area.

Shales of suitable character for the manufacture of clay products are rare, either because the deposits of argillaceous material are too siliceous, or else because they have been metamorphosed to a slaty or schistose condition.

There are several localities, however, in which promising shale beds are known.

Beginning at the north, shale beds are found associated with the Cretaceous coals in Jasper Park, which may prove useful for brick manufacture, but they have been so little developed that no definite information can be given regarding them.

In the Crows Nest pass shales which can be employed for dry-pressed brick are found in the Benton, near Blairmore. Others found near Sentinel can be used for sewer pipe manufacture. Southeast of Blairmore still other Benton shales are known which if present in sufficient abundance are worth utilizing for pressed brick.

In the Nicola valley, there are shales associated with some of the coal beds, that could be utilized for brick and fireproofing.

Of the surface clays there are a large number of small deposits, that could be employed in common-brick manufacture. One of the most extensive is that found in the Nicola valley between Merritt and Nicola, which is adapted to brick and tile making.

The most remarkable surface clay deposit found in the mountains, however, is the vast silt deposit occurring in the upper Columbia valley and described in the present report, and for which the only use suggested is the manufacture of scouring brick. It works well for this purpose.

PACIFIC COAST REGION

This includes the territory lying west of the Coast Range, and while limited in the extent of its clay resources, contains a considerable variety of plastic materials. These may be grouped under the following heads.

(1) The shale deposits of Sumas mountain. These form an important series of varying character, adapted to the manufacture of pressed and paving brick, firebrick, fireproofing, sewer pipe and roofing tile.

There is no other locality thus far discovered in Canada which contains such a variety of materials. Two factories are using the shales at the present time.

(2) Plastic surface clays of the lower Fraser Valley. These are red-burning clays, which form the basis of a thriving brick and tile industry. They are worked at New Westminster, Port Haney, Ruskin, etc.

(3) The Northumberland shales of the Cretaceous formation on Vancouver Island. These in general represent hard and often gritty shales, which are red burning, but do not possess much plasticity. With proper care they can be made into bricks.

(4) Glacial clays on southern Vancouver Island and some of the smaller islands between Vancouver Island and the main land. These are red burning and utilized for brick.

(5) Residual fireclay, found near Kyuquot or northwestern Vancouver Island.

(6) Deposits of glacial clay scattered along the coast, and which could be worked later to supply the Prince Rupert market.

CONCLUSIONS

After having covered most of the accessible portion of the territory of the western provinces, I think it is safe to say that the different formations mentioned carry a variety of clay resources which it will pay to develop.

Personal Mention

Mr. M. A. Woods, is taking charge of the Engineering Department of the Grand Trunk Pacific, in place of Mr. B. B. Kelliher, who has resigned. Mr. Woods' headquarters will be at Winnipeg.

The latest membership list of the Institution of Municipal Engineers (Great Britain) contains the names of the following Canadians: Mr. L. E. Allen, Belleville, Ont., Engineer for the County of Hastings; Mr. A. W. Ellson Fawkes, Waterworks Engineer, Calgary, Alta.; Mr. E. C. A. Hanson, City Electrical Engineer, Saskatoon; Mr. G. H. Hatfield, Road Engineer, St. John, N.B.; Mr. W. Murdoch, City Engineer, St. John, N.B.; Mr. G. D. Weaver, Town Engineer, Melfort, Sask.

Mr. M. A. Lyons has been appointed Chief Engineer of the Manitoba Highway Commission, with headquarters at Winnipeg. Mr. Lyons graduated from the Massachusetts Institute of Technology in 1910. He was transitman with the Halifax & Southwestern Railway during the year following, and also served as draftsman for the Coffin Valve Company. In 1911 he was made Assistant Engineer for the Canadian Pacific Railway in the Irrigation Department. In 1912 he was appointed Drainage District Engineer for the Manitoba Department of Public Works. Since 1913 Mr. Lyons has been Bridge Engineer for that department. Other engineers appointed to the Highway Commission are Messrs. T. T. Wilson, J. B. Phillips, W. Youngman, R. Whitside and F. Minnville.

Mr. B. B. Kelliher, Chief Engineer of the Grand Trunk Pacific Railway has resigned, owing to ill-health. Mr. Kelliher has been engaged in railroad construction for some thirty years. For ten years he has been actively engaged in the building of the Grand Trunk Pacific. Mr. Kelliher was in charge of the entire construction scheme for nine of these ten years. The first sod of the Grand Trunk Pacific was turned a few days after his appointment as Chief Engineer, and the last spike was driven this summer, marking the completion of the transcontinental system. Mr. Kelliher was born in Ireland and educated at Dublin University. After serving as an apprentice to a civil engineer in Dublin and being engaged on the surveys for the Mitchellstown and Fermoy and the Galway and Clifton roads, he went to the United States. From 1886 to 1890 he was with the Union Pacific Railway and from 1890 to 1896 he was assistant engineer of the Northern Pacific road on the Cascade and Pacific Divisions. He was chosen for the difficult task of locating a line through the mountains of Colorado from Denver to Salt Lake City for the Denver North-Western and Pacific Railway, and joined the Grand Trunk Pacific on the completion of this work as Division Engineer at Winnipeg.

Prospective Road Work in Ontario

It is understood that tentative plans have been made by the Ontario Government with a view to providing road work for a large number of men during the fall and winter. The largest undertaking in sight is the Toronto-Hamilton highway, which will entail an expenditure of some $800,000. The Provincial Highways Department has completed a working survey of the road, and estimates and data have been secured. The municipalities interested are all in favor of the improvement, and co-operation will open the way for construction with practically no delay. While nothing definite has yet been arranged, the prospects for activity in this field are bright.

Toronto Building Undermined by Excavators

As a result of excavations made for the new Excelsior Life Building at Toronto, the north wall of the Union Loan Company's building collapsed last week. The wall collapsed in the evening, after cracks had become more and more perceptible all day. The building had been cleared and there were no casualties of any kind, but the damage was estimated at $15,000. The contractor for the excavating is Aldophe Meyers, who is carrying out the work for Messrs. Peter Lyall & Company. It is stated that an action will be brought against the contractor. Mr. Meyers holds the City Architect's Department responsible, claiming that the work was inspected daily.

Welland Canal Operations

Messrs. Baldry, Yerburg & Hutchinson, contractors for No. 2 Section of the Welland Canal, are making good progress. It is stated that the average output of No. 2 Section is fifty trains a day of ten cars each. Each car contains from twelve to fifteen yards of dirt. Recently one of the contractors' cars broke from the train and took a dive of some twenty feet into Lake Ontario. No effort has been made to raise the car, so far, as the trestle over which it plunged will not stand the strain of the large wrecking crane belonging to the Dominion Government. The old Queenston road at Homer has been diverted pending the erection of the fine steel bridge at this point, which will be one of the largest on the great waterway. Lane Bros., sub-contractors for the Dominion Bridging Company on No. 1 Section, are erecting fifty-six feet of steel framework, which is being filled with concrete and will constitute one of the largest inside harbor piers. On No. 1 Section there are two steam shovels and two drag lines at work.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The city of Peterborough, Ont., has effected a loan of $100,000 for a hydro-electric extension.

The plant of the Canada Wire Nail Company, of West St. John, N.B., is about to be put in operation.

It is probable that the Bank of Montreal will lend the city of Montreal $6,000,000 for the completion of permanent works now under construction.

The proposed registry office at Toronto will cost nearly $400,000. Motion has been made to have a by-law covering the amount introduced into council.

The Merrickville, Ont., ratepayers have carried a by-law to finance the Merrickville Power Company to the extent of $30,000 in the installation of an electric power plant.

The contract of the Toronto Structural Steel Works with the City of Toronto for the structural steel work on the new Registry Office has been confirmed at $41,000.

The marble works of A. E. McLean Company, at Athens, Ont., were destroyed by fire recently. The local press suspects incendiarism, the plant having been broken into a few days previously.

The Property Commissioner of the Toronto Board of Education is negotiating for a site of four and one-half acres on Runnymede Road, to be used as a site for the new Annette Street School.

Montreal building permits for last month totalled $1,114,745, a decrease of $1,203,927. For the year to date the total is $12,158,177, a falling off of $1,658,445. The number of permits is larger, but the average value shows a decrease.

The interior work on the new post-office which the Dominion Government is erecting at Fredericton, N.B., at a cost of $133,000 is nearing completion. The general contractors for the building are Messrs. Falconer & McDonald, of Halifax.

At Oakville, the work of erecting the new orphanage of the I. O. O. F. is proceeding expeditiously. It is hoped to have the building completed by the end of October. The orphanage, which is of solid brick and fireproof construction, will cost $60,000.

Monday next, September 14, is the closing date for the receipt of tenders for the new public building which is to be erected at Peterborough. The project belongs to the Department of Public Works (Ottawa) of which Mr. R. C. Desrochers is the Secretary.

Tenders will probably be called in about six weeks for the new station which is to be erected at Lagauchetiere and St. Monique Streets by the Canadian Northern Railway at an estimated cost of $250,000. The architects are Messrs. Warren & Wetmore, New York City.

Last week the Toronto Works Commissioner, Mr. R. C. Harris, requested the Board of Control to let him purchase $70,000 worth of paving material without advertising for tenders, so as to expedite the work. Permission was refused and the supplies will be obtained in the usual manner.

The foundations are in for the new church which is to be erected on Grace Street, Toronto, for St. Francis (R.C.) parish. The new building will be 80 ft. by 160 ft. in dimensions, of stone, steel and brick construction. The architect is Mr. A. W. Holmes, and the general contractor is Mr. R. Sheedy.

Foundation work is in progress on the $100,000 apartment house which is to be erected at Bay and Herkimer Streets, Hamilton, Ont. The building will be six storeys high, 125 by 65 ft. in dimensions, of reinforced concrete and fireproof construction. The architects are Messrs. Stewart & Witton, Hamilton, Ont.

It is expected that by the end of the year the Canadian Northern Railway direct line from the west, via North Bay to Ottawa and Quebec, will be finished. There still remains forty miles of road unconstructed east of North Bay. The company anticipate a busy winter and are rushing repair work between Toronto and Port Arthur.

The Dominion Chain Company are proceeding with the erection of their factory at Niagara Falls. The new building is two storeys high, 100 ft. by 440 ft. in dimensions, of stone, steel and reinforced concrete construction. The general contractors are Messrs. Austin & Sons, Cleveland, and the architect is Mr. E. D. Pitt, Niagara Falls, Ont.

At Halifax, while no extensive building work was started last month, good progress was made in operations under way. Railway terminal work continues, and the pier contractors are erecting temporary buildings for their machinery and plant. The Dalhousie library building and the city market building are under way. Residential work is fairly active.

The Dominion Government have practically concluded an arrangement with the representatives of the Grand Trunk Pacific and the Canadian Northern by which advances will be made the two companies sufficient to let them proceed with the completion of their transcontinental lines until the bonds for that purpose, guaranteed by the Dominion Parliament, can be financed.

Operations on the new waterworks scheme at North Toronto are progressing rapidly. The foundation of the pumping station is in, and the laying of the eighteen-inch steel intake pipe is well under way and will be completed in six or seven weeks according to the contractor, Mr. J. F. Curley. It is expected that the whole system will be completed and in operation by the middle of November.

From St. John, N.B., comes the report that the western half of the new spandrel arch bridge over the Reversing Falls is now finished and the remaining portion of the work is in progress. Upon the completion of this bridge it is expected that there will be greatly increased development at Lancaster and West St. John. Already, in anticipation of its completion, considerable residential work is in progress.

Exterior work on the Old Peoples' Home, now under construction at St. Laurent (Montreal), is nearing completion. The roofing work is now in progress. The building is to be three storeys high, 200 ft. by 80 ft. in dimensions, of reinforced concrete construction. The architect is Mr. A. Piche, and the general contractors are the Atlas Construction Company, Montreal. The estimated cost is $250,000.

Considerable progress has been made with the extensive pulp and saw mills being constructed at Chandler, P.Q., for the St. Lawrence Pulp & Lumber Corporation. Twenty-five miles of railroad have been graded and 15 miles of track laid, while another ten miles is in course of being laid. The pulp mill is nearing completion. The company's town-site is practically finished, there being between sixty and seventy houses occupied. In addition, new houses are being erected by tradesmen and labourers.

According to a dispatch from Charlottetown, P.E.I., work on St. Dunstan's Cathedral is progressing very satisfactorily—"although it is delayed," we are told, "by lack of men. One hundred and ten men are now employed, but the contractor could find work for many more." Progress on the building has reached the roof, which is now almost covered. The height of the building from the ground to the top of the spire is about one hundred and seventy feet. The general contractors are the John S. Metcalfe Company, Montreal.

It is now three months since the Maritime Dredging and Construction Company took over the contract for the West Side piers at St. John, N.B. In that time much work has been accomplished, with dredges, reclamation plants and concrete mixers. About five hundred men are now employed. Nearly all the concrete face of one pier has been completed, and good progress has been made with the two piers below. There are 90,000 yards of filling yet to be done, but at the rate of progress that is being made this filling will be completed in good time for this season's work. A temporary wooden warehouse, 80 x 350 feet, will be placed on Pier 14.

Tenders for the proposed High School of Commerce, at Toronto, exceeded the amount voted by some $13,000. The Board of Control will recommend Council to pass the additional amount. The original estimated cost of the building was $250,000. Following are the principal contracts awarded last week: masonry, Messrs. R. Robertson & Sons, Limited, Toronto, $92,681; carpentry, Messrs. Crocker & Ledrew, Toronto, $44,640; plumbing, heating and ventilation, Messrs. Purdy, Mansell, Limited, $51,809; concrete floors, A. C. Richmond, Toronto, $10,750. The building will contain three storeys and basement and will be of structural steel, terra cotta and brick construction.

WESTERN CANADA

Western press reports state that a brass manufacturing plant is to be established at Redcliff, Alta.

At Regina, operations are well advanced upon the new $45,000 block which is being erected for Mr. E. McCarthy according to plans prepared by Messrs. Storey & Van Egmond.

It has been decided to take fresh tenders for the drill hall which the Dominion Government proposes to erect at Vancouver. The estimated cost of the new building is $350,000. The construction will be of stone, reinforced concrete, brick and steel.

The Provincial Highway Commission of Saskatoon are planning the expenditure of $500,000 on road work in the southern part of the province this fall. The work will be carried out by day labor. Mr. F. J. Robinson, Regina, is Chairman of the Commission.

Tenders for eighty-five miles of concrete aqueduct construction for the Greater Winnipeg Water District close on Saturday, September 19th. Mr. S. H. Reynolds, 901 Boyd Building, Winnipeg, is Chairman of the Greater Winnipeg Water District Sommission.

Tuesday, September 8, was the last day for submitting tenders for the new jail building which is to be erected by the city of Victoria, B.C. The tenders comprised separate bids for building construction, sanitary equipment, prison iron work, electrical equipment and mechanical and heating equipment.

Plans have been prepared for two docks which the Department of Public Works of the Dominion Government will build at Winnipeg. One dock, at Rover Avenue, will be 351 ft. long and 30 ft. wide, and the other, at Notre Dame Avenue, 57 ft. long and 30 ft. wide. Open pile construction will be employed.

Nearly seven thousand men are employed in the construction of the Pacific Great Eastern Railway between Chekamus and Fort George, B.C. Track-laying is in progress beyond Chekamus, where a number of bridges have been completed. Practically all the grading has been finished between Squamish, B.C., the ocean terminus of the line, and Lillooet, B.C.—a distance of one hundred and twenty miles.

Announcement is made by Sir Donald Mann, vice-president of the Canadian Northern Railway, that it is the company's intention to complete the transcontinental line as quickly as possible, despite the chaotic conditions brought about by the war. At the time of writing, Sir Donald is in Victoria, B.C., conferring with Premier McBride. The Canadian Northern Railway has three thousand men employed in British Columbia. These men will be kept at work until the rail-laying is finished.

Montreal Exchange Sets Example

The Secretary of the Montreal Builders' Exchange has circularized the membership with a view to drawing attention to the local building situation and devising means of improving existing conditions. He points out that there should be at least another two months of outside work and that if operations are closed down at this early stage it will result in a winter of unparalleled hardship for the working classes. Supply houses and contractors are asked to cut their profits to a minimum.

No Advance In Pedlar Products

The Pedlar People Limited, Oshawa, express agreement with the principles of the article, "The European War in Its Relation to Canadian Trade," published in the Contract Record of August 26 and state that they will be pleased to furnish at no advance in price their corrugated culverts for use in connection with road work, should the province or any of the municipalities decide to employ men in this department of activity during the present emergency. They state that the offer is made notwithstanding an advance in price of the raw material. It is pointed out that such road work will provide work for many workmen not only directly but indirectly, as it will tend to maintain factory labor.

In the editorial article to which reference is made, it was shown how the present conditions should ultimately mean considerable expansion of the country's trade and how everything depended upon the exercise of courage and confidence.

The Algoma Steel Corporation, Limited, Sault Ste. Marie, Ont., are discontinuing their Sales Office at 606 McGill Building, Montreal. All material manufactured by them will be sold through their Sales Department at Sault Ste. Marie.

From the National Paving Brick Manufacturers' Association, Cleveland, Ohio, we have received advance copies of the revised edition of "Specifications for the Construction of Vitrified Brick Street Pavements and Vitrified Brick Highways." Copies of these Specifications, with booklets on the subject of brick pavement construction, will be furnished upon request.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Brampton, Ont.
The Town Council has decided to call for tenders for sewers on Guest street, at an estimated cost of $3,800; Frederick, $1,400; Elizabeth, $1,080; Park, $600 and Centre $1,300. W. H. McFadden is the clerk.

Brooke, Ont.
The Township Council will receive tenders until noon September 21, for the construction of a drain. Plans and specifications are at the residence of the Commissioner, Lot 13, Con. 6, Brooke, Ont. Tenders are to be sent to W. J. Bourne, Alvinston P.O.

Brantford, Ont.
City may purchase motor combination wagon in a few months. F. Ryerson is Chairman, Fire Committee.

Guelph, Ont.
The City Council has had plans drawn for the construction of a sewer on York Road, at an approximate cost of $13,360. The work will be done by day labor and the materials estimated are 5,304 ft. of 18-in. glazed sewer pipe and 300 ft. of steel pipe at river crossing.

Halifax,N.S .
The purchase of one motor combination chemical and hose wagon, two tractors, and a chief's car is planned for early next year. P. J. Broderick is Chief.

Tenders are in with the Clerk of Works for the laying of pavements on six streets. On three of the streets the pavements will be granite block. F. W. W. Doane, City Hall, is the engineer.

Montreal, Que.
The Board of Montreal City Commissioners contemplates the purchase of an electrically driven pump for disposal of sewage at Pt. St. Charles.

Norfolk County, Ont.
The county council has invited tenders for the construction of a reinforced concrete culvert on the town line between Haldimand and Norfolk. Specification and plans are with J. Parsons, Jarvis, Ont. E. Boughner, Simcoe P.O., is the County Clerk and Guy R. Marston, C.E., the Engineer.

Ottawa, Ont.
The report of the waterworks engineer, R. L. Haycock, has been adopted by the Board of Control in favor of a sewerage system to drain the Mechanicsville District of Ottawa, mainly rock excavation, at an estimated cost of $60,000. John Henderson is the City Clerk.

The City Council is contemplating the purchase of a new set of pumps for Lecieux Island pumping station.

Plans are in progress preparatory to the construction of waterworks improvements at an estimated outlay of $63,000, and the City Council will call for tenders, one large pump (elec.) included. R. L. Haycock is the waterworks and sewerage engineer.

The City Council has had plans drawn for a $7,000 pavement on York street The approximate quantities are wood block, 1,353 sq. yds., butter, 820 lin. ft.

Plans are drawn for the construction of pavements on Anglesea Square North, for the city council, at an outlay of $6,000. The approximate quantities of material required are: 1,004 square yards of wood block, 400 lineal feet of curb and gutter, and 400 lineal feet of gutter. F. C. Askwith is the engineer.

Peterborough, Ont.
The City Council has passed a by-law authorizing the construction of sewers on Bethune, Cambridge, Chamberlain, Hunter, and Lake streets and Monaghan Road. S. R. Armstrong is the Clerk and R. H. Parsons the Engineer. The City Council has also adopted a by-law providing for the construction of sidewalks on twenty-two streets.

Penetanguishene, Ont.
The Light and Water Commission is receiving tenders for the construction of a cement wall at the supply station, 50 ft. in diameter by 12 ft. deep. Plans and specifications are at the office of the Commissioner.

St. John, N.B.
Work on the construction of a sidewalk on King Square for the city council, is being carried out by day labor. The Commissioner of Works is Mr. F. Potts.

Sherbrooke, Que.
The City Council has decided to start work shortly on the construction of sidewalks on Frontenac, King, Depot and Galt streets, and 1st Ave. The work is to be done by day labor. E. C. Gatien is the secretary-treasurer.

Sydney, C.B.
The Town Council has in contemplation the purchase of a centrifugal pump and motors, with switchboard, for the waterworks system, with a capacity of four million gallons per day. W. A. Richardson is the Mayor and Norman Hay is the engineer.

Saskatoon, Sask.
City is considering the purchase of motor pumping engine and motor city service truck this year. Thos. E. Heath is Chief.

Toronto, Ont.
Tenders will be received by the Chairman, Board of Control, until Tuesday, September 15th, for the excavating, laying and jointing of 42-in. and 36-in. cast iron water pipes, valves and special castings. Specifications, etc., may be obtained upon application to the office Water Main Extension Section, Dept. of Works, City Hall.

Tenders will be received until September 15 by the Board of Control, for the construction of sewers on Armadale. Danforth, Evelyn Glendonwynne and Windermere Streets, also for the construction of a sewer system on Division 2, West Toronto. Plans are to be seen at the office of the Works Department, City Hall.

Tenders close September 15 for the work of excavating, laying and jointing of 42-in. and 36-in. cast iron pipes, valves and special castings for the Board of Control. Plans, etc., are available at Room 9, City Hall.

Vancouver, B.C.
The Nairn Falls Power Co., Ltd., 811 Rogers Building, is applying for a license to store 100,000 acre feet of water by reservoir, etc., in connection with the Soo River.

The city council has in contemplation the construction of a 900-ft. 6-in. waterpipe on Trafalgar Road, at an estimated outlay of $1,700, also 750 ft. water pipe with one hydrant, on Third Avenue, for the purpose of fire protection. Mr. Wm. McQueen is the City Clerk, and Mr. Breckon is Waterworks Commissioner.

Winnipeg, Man.
Tenders addressed to S. H. Reynolds, Chairman of Commissioners, Greater Winnipeg Water District, will be received until noon, September 19th, for the construction of eighty-five miles of concrete aqueduct in five sections of approximately equal length. Plans, specifications and form of tender can be had on application to the District.

The Board of Control is contemplating the laying of asphalt No. 1 pavement on Salter street, at an estimated cost of $68,913. M. Peterson si the secretary.

The construction of sewers on Guelph street, at an estimated cost of $330, and on Salter street at a cost of $3,110, is contemplated by the Board of Control.

The following sidewalks are to be laid by the Board of Control: plank walks on Mulvey, Bannerman and Higgins Aves., and Academy Road, cost $1,772; granolithic on Derby street (2 sides) Spence, Austin and Helen streets, cost $5,263.

CONTRACTS AWARDED

Gambie, B.C.
The contract for dykes and flood boxes has been awarded by the Municipal Council to J. W. Pyke, at $24,465.20. Cleveland and Cameron, Rogers Building, Vancouver, are the engineers.

Hamilton, Ont.
The city council has awarded the following contracts for sewerage construction: S. Cheeseman, $1,410; J. D. Armstrong, $987; J. J. Armstrong & Sons, $1,044 and $950 respectively for construction on Hope and Bay streets.

Tenders and For Sale Department

Vancouver Civic Centre 1914

The Committee appointed by His Worship Mayor Baxter invite competitive designs for the development of the proposed Civic Centre. Premiums amounting to $500 and $250 will be awarded to the designs placed first and second respectively. The award will be made by independent experts whose decision shall be final. All designs must be delivered not later than November 30th, 1914. Programme of competition and plans may be obtained from the Secretary, Vancouver Civic Centre Committee, care Vancouver Board of Trade, 543 Hastings Street West, Vancouver, B.C. 36-39

Tenders for Restaurant Privileges

Sealed tenders addressed to the undersigned, marked on envelope "Tenders for Restaurant Privileges," will be received up to 12 o'clock noon, **September 15, 1914**, for the privileges for periods of one year, two years, five years, at the following places—leases to become effective from the dates mentioned.

Timagami Restaurant—from February 10, 1915.

Englehart Restaurant—from October 1, 1914.

Cochrane Restaurant—not yet opened.

Parties tendering will be required, if found necessary, to furnish bond that any agreements entered into will be carried out.

Highest or any tender not necessarily accepted.

Dated at Toronto this 22nd day of August, A.D. 1914.

A. J. McGEE, Secretary-Treasurer,
T. & N. O. Railway Commission,
35-36 25 Toronto St., Toronto.

Tenders for Laying and Jointing of Water Pipes, etc.

Tenders will be received, by registered post only, addressed to the Chairman of the Board of Control, City Hall, up to noon on **Tuesday, September 15th, 1914**, for the Excavating, laying and Jointing of 42-in. and 36-in. Cast Iron Water Pipes, Valves and Special Castings.

Specifications and tender forms for the foregoing may be obtained upon application at the office of the Water Main Extension Section, Department of Works, Room No. 9, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. Conditions relating to tendering, as prescribed by city by-law, must be strictly complied with, or the tenders may be declared informal. Tenderers shall submit with their tenders the names of two persona sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company, approved as aforesaid.

The lowest, or any tender, not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
City Hall, Toronto.
August 31st, 1914. 36

Tenders Wanted

For competitive plans and specifications for a Carnegie Public Library Building complete with equipment, at a cost of $15,000. Architects to state price for plans and specifications complete if Council decides not to employ architect to supervise building. No plans necessarily accepted.

Tenders to be received not later than September 19th, 1914, and to be addressed to E. Donnell, Town Clerk, Barrie, Ont.

Barrie, August 25th, 1914. 35-36

TOWNSHIP OF MINTO

Tenders Wanted

Sealed tenders marked "Tender for Drain No. 5, Minto," will be received by the undersigned up to 2 p.m. on **Monday, September 14th, 1914.**

The Council will proceed to consider the tenders immediately after the above hour at the Township Hall, Minto.

Plan, profile and specifications can be seen at the Clerk's office or at the office of C. D. Bowman, Esq., O.L.S., West Montrose.

The drain commences on lot 114, Con. D. and has its outlet on lot 23, Con. 3, Minto, and is nearly six miles long.

The lowest or any tender not necessarily accepted. A deposit of $400, cash or marked cheque, is required to accompany each tender.

W. D. McLELLAN;
Clerk, Township of Minto.
Harriston, Ont.
Harriston, August 31st, 1914. 35-36

Sealed tenders addressed to the undersigned, and endorsed "Tender for Electric Elevator, etc., for the Public Building, Brantford, Ont.," will be received at this office until 4 p.m. on **Wednesday, September 16, 1914**, for the installation of an electric passenger elevator to include motor generator set, etc.

Plans, specification and form of contract can be seen and forms of tender obtained on application to Mr. G. W. Hall, Supervising Architect, Brantford, Ont., at the office of Mr. Thos. A. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, August 27, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—66051. 35-36

Greater Winnipeg Water District

Tenders for Aqueduct Construction

Sealed tenders addressed to the undersigned will be received up to noon of **Saturday, 19th September, 1914**, for the construction of Eighty-five miles of concrete aqueduct in five sections of approximately equal length.

Plans, specifications and form of tender can be secured after July 20th, 1914, by application to the District accompanied by certified cheque for One Hundred Dollars payable to the District, which deposit will be returned upon submission of tender or return of documents.

Bidders may tender on any section or on any number of sections.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,
Chairman of Commissioners
901 Boyd Building,
Winnipeg, Man., July 6, 1914. 30-36

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, September 15th, 1914**, for the construction of the following sewers, viz.:

Armadale avenue, Bloor street to Colbeck St.

Danforth Ave., Main Street to Dawes Road.

Evelyn Ave., Annette Street to Glendonwynne Road.

Glendonwynne Road, Bloor Street to Glenholme Drive.

West Toronto Sewer System, Div. No. 2, outlet from 353 feet north of Conduit street, on Woodville Ave., to Birtle Ave. and Indian Road, via lots Nos. 98, 134, 133, Plan M., and 41 Birtle Avenue.

Windermere Ave., Bloor St. to Annette St.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen, and forms of tenders obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit their tender, the names of two sureties, approved of by the City Treasurer, or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid. Conditions relating to tendering, as prescribed by city by-law, must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
City Hall, Toronto.
August 31st, 1914. 36

FOR SALE

One travelling Derrick, 3 drums and swinger, 65 ft. Boom, 7 x 12 Engines; Beatty make. One 1-yd. Owens Clam Shell Bucket. All in splendid working condition.

GUTTERIDGE & GRACE,
35-36 Sarnia, Ont.

FOR SALE—One "Smith" concrete mixer in first class condition. Cost $950. Will sell for $600 cash. Apply Box 72, Contract Record, Board of Trade Building, Montreal 33-36

Positions Wanted

Position wanted by a first class artificial marble worker. Imitation guaranteed with all the modern commercial improvements. Ready to take charge of any job. References given. Box 337, Calgary, Alta. 35-36

Agents Wanted

Large firm making diaphragm pumps with improved patent valves wants to secure agents in Canada. Pumps made in all capacities up to 14,000 gallons per hour. Workable by hand or mechanical power. Address Box 70, Contract Record & Engineering Review, Toronto. 32-37

Waterworks, Sewerage and Roadways

(Continued from page 63)

St. Thomas, Ont.

The general contract for the construction of 6,000 square feet of sidewalk on Balaclava and Wellington streets has been awarded to A. Little, by the city council, at 12½c per sq. ft.

Toronto, Ont.

The Board of Control has awarded the contract for a storm overflow sewer on Lappin Ave and Hallam street, at a cost of $28,350, to Connolly-Agnew Construction Co., Toronto.

The Board of Control has transferred certain work from the Commissioner of Works and the following contracts have been awarded: Godson Contracting Co., 7 streets $46,880; Constructing & Paving Co., 5 streets $28,411. The contract for bitulithic pavement on 7 streets is awarded to Warren Bituminous Paving Co., at $59,521.

The board of control has awarded contracts for the construction of the following sewers in the City of Toronto: Arpen Co., Ltd., Ethel Cres., $565.; Glenmannor, $925. Frank Angotti, Cumberland street, $2,595; Mr. H. Murphy, Main street, $4,567; Scollard street, $3,475; Spears Ave., $3,552; Williard Ave., $1,967. John Maguire, Ardagh Ave., $723; Glenholme Ave., $568.

Vancouver, B.C.

The City Council has let the contract for the supply of 1,000 feet of 16-inch water pipe to the Crane Co., Vancouver, at $2,030.20.

Winnipeg, Man.

The contract has been awarded by the Board of Control to J. W. Astley, Engineer of Construction, City Yards, for the laying of the asphalt pavement on O'Meara Street, at a cost of $1,565.32. M. Peterson is the Clerk and W. P. Brereton the engineer.

The board of control has awarded the general contract for a watermain on Airlies street, at a cost of $313.32, and a watermain on Ingersoll street at an outlay of $135.36, to J. W. Astley, Engineer of Construction.

The following contracts have been awarded for asphalt street-paving to J. W. Astley, by the board of control: Academy Road, $48,698.36; S. Tuxedo Ave., $4,598.44; Watt street, $12,470.00; Kenaston Blvd., $14,267.20; Lenore St., $5,161.96; Lipton street, $9,899.20; St. John's Ave., $3,100.20; Levis street, $3,765.80; Ruby street, $6,665.65; Basswood Place, $5,309.44; Greenwood Place, $7,358.34.

The board of control is laying concrete pavements on two lanes at a cost of $7,251.45, and concrete pavements on two lanes at an expenditure of $5,133.40, the general contract for which has been awarded to J. W. Astley.

Railroads, Bridges and Wharves

Barrie, Ont.

The town council has started work by day labor for the construction of a reinforced concrete culvert, 66 ft. wide and built of pile foundation, the estimated cost of which is $3,000.

Fort William, Ont.

The Fort William board of trade has recommended to the city council that the latter request the Railway Board to have the new C. N. R. depot constructed on Main street instead of Vickers street.

Montreal, Que.

It is reported that tenders will be called in about six weeks in connection with the construction of the $250,000 station at Lagauchetiere & St. Monique streets, for the Canadian Northern Railway. Warren & Wetmore, New York, are the architects.

Moose Jaw, Sask.

The Grand Trunk Pacific Railway has selected a site for the erection of a station. J. P. Kirkpatrick, Regina, is the superintendent.

Perce, Que.

Tenders addressed to A. Johnston, Deputy Minister of Marine & Fisheries, Ottawa, will be received until October 1, for the construction of a reinforced concrete sewer at Perce, County of Gaspe, Que. Plans and specifications, etc., are available at the Department of Marine & Fisheries, Ottawa, at the agency of this Department, Quebec, and at the post offices: Bathurst, Chatham, Liverpool and Campbellton.

Parham, Ont.

The C. P. R. has in contemplation the installing of sidings at Parham Station. J. T. Arundel, of Toronto, is the general superintendent.

West Luther, Ont.

The township council has invited tenders which will be received by the clerk, W. W. Duncan, Conn, Ont., or Reeve E. G. Boyd, Damascus, Ont., until noon, September 12, for the construction of a 12-ft. concrete bridge on the 12th concession above the township. Plans and specifications are with the Clerk and Reeve. Bowman & Conner, 16 King St. W., Toronto, are the engineers.

Winnipeg, Man.

Plans have been prepared and work will commence shortly, under supervision of the Department of Public Works, on the construction of two docks at an approximate cost of $200,000. The work will consist of a dock at Rover Avenue, to be 350 ft. long by 30 ft. wide, also a dock on Notre Dame Ave., 57 ft. long by 30 ft. 3 ins. wide, open pile construction with 5 ft. centres.

CONTRACTS AWARDED

New Glasgow, N.S.

The municipal council has re-awarded the general contract for the construction of "Potters" Bridge to Captain Peter Graham, Abercrombie Street. The bridge which will cost about $7,500 consists of two spans 200 x 40 feet, steel and concrete construction. E. S. Fraser is the engineer.

Nova Scotia (Province)

The Provincial Government, Depart- of Public Works, has awarded the general contract for thirteen bridges to the Eastern Steel Co., Ltd., Trenton street, New Glasgow, N.S. The bridges are to be erected in various parts of the province. E. H. Armstrong, Halifax, is the Commissioner.

Sudbury, Ont.

The town council has awarded the general contract for the construction of reinforced concrete bridges as follows: Durham street bridge, Messrs. Gustiana & Cecchetto, $6,000; Larch street bridge, Messrs. Johnson & Baikie, $3,473; Minton street bridge, Messrs. Sherwood & Sherwood, $4,100. The Station street bridge contract has not yet been awarded. W. J. Ross is the Town Clerk.

Winnipeg, Man.

The board of control has awarded the contract for steel towers and the necessary steel work for the construction of a duplicate transmission line between Winnipeg and Point Du Bois, to the Dominion Bridge Company, Limited, Canada Building. J. G. Glassco, 54 King Street, is the engineer.

Public Buildings, Churches, Schools, etc.

Ayr, Ont.

Tenders will be received until 7.30 p.m., September 15th, for altertaions to Knox United Presbyterian Church. Plans, etc., are with the architects, Evans & Fulford, Scott & Bennett Block, Galt, and John Folsetter, Ayr.

Antigonish, N.S.

Funds are being raised for the construction by the St. Francois Xavier Athletic Association, of a skating rink at an estimated outlay of $35,000. The probable architect of the building, which will be two storeys, 110 ft. by 50 ft., is C. W. West, St. Peter's Rectory.

Dundas, Ont. (Hamilton)

The Methodist Church Board, the Secretary of which is W. H. Moss, has awarded the general contract for an addition to the Sunday School at an outlay of $4,000, to Thos. E. Woods, Dundas, and the plumbing contract to Louis Gies, Dundas. The architect is John E. Walker, Toronto. The building will be of brick construction.

Eganville, Ont.

Work is to start immediately on the construction of a $5,000 manse, of frame and brick veneer construction, for the Presbyterian Church Congregation. The general contractor is John McIntyre.

Fort Frances, Ont.

The Town Council has awarded the contract for the construction of a public library of two storeys, solid red brick construction, at an estimated cost of $8,500, to A. F. Scott, care Secretary, Library Board, Rev. J. R. Harris. The building will be erected on Church St. and Victoria Ave.

Grafton, Ont.
The Public School Board has suffered the loss of its school building which has been destroyed by fire.

London, Ont.
Interior work is to start shortly on the Sunday School building in course of erection for the Wellington Street Methodist Church, at a cost of $12,600. The building is of steel and white brick construction.

Maisonneuve, Que. (Montreal)
Tenders are invited by the architects, Messrs. Peden & McLaren, 20 St. Alexis street, Montreal, for the general contract in connection with the construction of a church on Pie IX. Avenue, for the Maisonneuve Methodist Church. The building is to be 60 ft. by 72 ft., of stone and brick construction.

North Vancouver, B.C.
The Government of British Columbia has decided to spend $100,000 on the preliminary construction stages of the Provincial University. It is reported that the work will proceed at once.

New Westminster, B.C.
Tenders will be received by J. E. Griffith, Victoria, Engineer for the Provincial Government, Department of Public Works, until noon, September 15th, for additions and alterations to Courthouse on Clarkson street, at an estimated outlay of $70,000. Plans and specifications are at the offices of the Government Agent, New Westminster and Vancouver, and also at the Department, Victoria. The building will be three storeys and basement, brick construction, pressed brick facing, Denman and stone trim. Gardiner and Mercer, West Trust Block, are the architects.

Oakville, Ont.
The County Council has decided to at once raise the money to carry on the work of the new County Registry Office. The tender of P. H. Secord & Sons, Brantford, was accepted at $10,845, to carry out the construction of the building.

Regina, Sask.
The project which was on foot for the construction of a warehouse for Scott, Bathgate & Company, Ackerman Building, at an estimated cost of $50,000, has now been postponed indefinitely. A previous report announcing the award of contracts was in error.

St. John, N.B.
The sub-contract for the plumbing and heating in connection with the new tuberculosis hospital has been awarded to F. S. Walker. F. Neil Brodie, 42 Princess street, is the architect and A. R. C. Clarke & Son, 51 Water street, the general contractor. The building is of frame construction.

Work is soon to be commenced on the construction of a tuberculosis hospital in the east end of the city for the Board of Hospital Commissioners. Mr. F. Neil Brodie, 42 Princess street, is the architect, and the general contractor is A. R. C. Clarke & Son, the contract for the carpentry being in charge of R. J. Green. The building will involve an outlay of about $80,000.

Truro, N.S.
Tenders will be received by Horace McDougall, Clerk of the Board of School Commissioners, until noon, September 12, for the erection of a three-roomed brick and concrete construction school building, at a cost of $40,000. Separate tenders will also be received for plumbing, heating and sheet metal work. Plans and specifications are at the office of the architect, E. D. Veron, Dominion St., and the building is to be completed by August 15, 1915.

Toronto, Ont.
Tenders will be received by J. S. Milligan, 347 Broadview Ave., for additions to Sunday School on 557 Bathurst St., estimated to cost $6,000. The buildings will be brick construction and foundation.

Plans for a nine-roomed addition to the Palmerston Avenue School, at an estimated outlay of $45,000, have been prepared by the Property Commissioner of the Board of Education, and tenders will be invited shortly.

The contracts which were awarded recently in connection with the $20,000 addition to the Huron Street School are to be cancelled. New tenders will be called shortly for the construction of an addition to the south of the present building.

The John H. Parker (Canada) Limited, 8 Colborne street, are receiving subtenders on the school to be erected near Thornhill, for the Christian Brothers Community.

Tenders close at 4 p.m., September 11, for the construction of a nine-roomed brick school building on Euclid Ave. for the Board of Education. Plans are available at the office of the Superintendent of Buildings.

A nine-roomed brick school building is to be erected on Margueretta street for the Board of Education, and tenders for the general contract will be received until September 11, at 4 p.m. The plans are at the office of the Superintendent of Buildings.

Tenders close at 4 p.m., September 11, for cabinet work on various schools, also for the removal of a building on Williamson Road for the Board of Education.

Tenders close at 4 p.m., September 11, in connection with the erection of a 12-roomed school building on Carlaw Avenue for the Board of Education. Plans are at the office of the Superintendent of Buildings.

Tenders have been called and will be received until September 11, at 4 p.m., for the construction of an addition to the John Fisher School. The addition will be four roomed, and brick construction. Plans are at the office of the Superintendent of Buildings.

Weyburn, Sask.
Plans have been prepared for the construction of a skating and curling rink for the Weyburn Arena Club, Limited, at an estimated cost of $35,000. Work on the building, which will be two storeys high, 120 ft. by 200 ft., reinforced concrete and steel construction, will not be commenced this year.

The architects, J. A. Ouellet, Dandurand Building, and J. O. Turgeon, 55 St. Francois Xavier Street, are receiving tenders for the general contract in connection with the construction of a club house, 4½ storeys, 110 ft. by 106 ft., on Cherrier street, for the National Amateur Athletic Association, at a cost of $200,000.

Winnipeg, Man.
The Board of Control has awarded to Frid-Lewis Company, Limited, Winnipeg, the general contract for the construction of public baths in Cornish Park, the amount of the contract being $41,850. D. W. F. Nichols, Somerset Building, is the architect, and W. P. Brereton, 223 James Avenue, the engineer.

The contracts for the carrying out of a brick addition, lavatory system, etc., to the House of Providence, Power St., at a cost of $10,000, have been let as follows: masonry, John McGlue; heating and ventilating, Gentle & Travis. Marble and tile contracts have not yet been awarded. The architect is J. P. Hynes, 199 Yonge street.

Walkerville, Ont.
Lincoln Road Methodist Church has awarded the following contracts for the construction of a two-storey brick and artificial stone church on Lincoln Road, at an estimated outlay of $40,000; masonry and plastering, J. R. Scullard; carpentry, the Williamson Construction Co.; steel, Canadian Bridge Co.; roofing and heating, Phillip Dresch; painting, R. W. Holloway; electrical work, McNaughton-McKay Electric Company, Limited. The plumbing contract has not yet been let. S. F. Walker Irvin is the architect.

CONTRACTS AWARDED

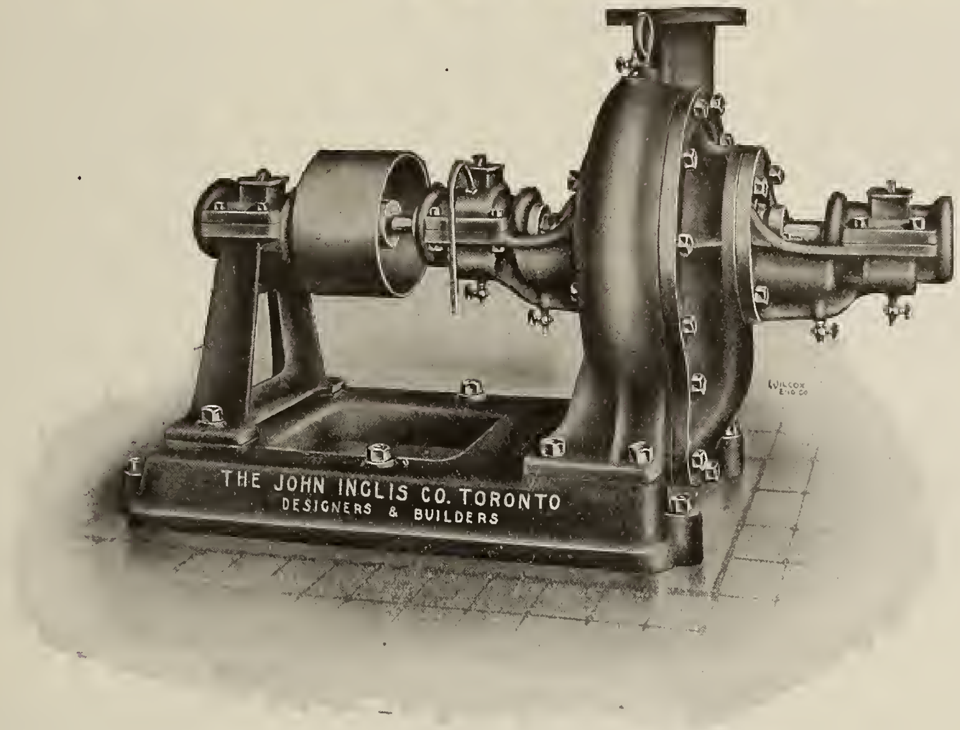
Nanaimo, B.C.
The contract for the erection of a six-roomed school at a cost of $25,000 for the Provincial Government Department of Public Works, has been awarded to F. T. Sherbourne, Vancouver, who is at present receiving sub-tenders.

Toronto, Ont.
The following contracts have been awarded in connection with the construction of a Commercial High School on Shaw and Dewson streets, at a cost of $260,000, for the Board of Education: Masonry, R. Robertson & Son, $92,681; carpentry, Crocker & Ledrew, $44,640; steel, Dominion Bridge Co., $14,950; plumbing, heating and ventilating, Purdy, Mansell, Ltd., $51,809; plastering, J. A. Berridge, $16,947; painting, James Phinnemore, $5,285; roofing and tinsmithing, Cruise Bros., $2,625; iron stairs, Shipway Iron, Bell & Wire Mfg. Co., $8,197; heat regulation, Johnston temperature Regulator Co., $3,000; electric wiring, F. Armstrong & Co., Ltd., $3,800; concrete floors, A. C. Richmond, $10,750; plastic cement floors, Missisquoi-Lautz Co., $7,130; floor lights, Luxfer Prism Co., $1,140. The building will be three storeys and basement, 24 rooms, reinforced concrete construction, structural steel, terra cotta and brick construction. W. C. Wilkinson is the secretary-treasurer.

The following contracts have been awarded in connection with the construction of the new Registry Office building: steel, Toronto Structural Steel Co., $42,600; and carpentry, Jas. A. Berridge, $19,984.

Additional contracts awarded in connection with the erection of a school on Connaught street, for the Board of Education, are as follows: Heating, Nobis Engineering Company, $1,390; plumbing,

PUMPS


THE JOHN INGLIS CO. TORONTO
DESIGNERS & BUILDERS

Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS
14 Strachan Ave., Toronto, Canada
Montreal Office: Room 509 Canadian Express Building

A. E. Melhuish, $725; wiring, Keiths, Limited, $297.

Business Buildings and Industrial Plants

Frankford, Ont.

The general contractor, Walter Alford, 211 George street, Belleville, Ont., is taking prices for trades in connection with the three storey brick and stone bank building for the Molsons Bank, Montreal, at an estimated outlay of $18,000. Turner & Carless, Beaver Hall Hill, Montreal, are the architects.

Hull, Que.

The city council, Mr. Boulay, Clerk, is receiving tenders for the erection of a storehouse at the Waterworks Pump House. J. A. Laforest is the engineer.

London, Ont.

Work has commenced on remodelling a store for the London Engine Supplies Company, at a cost of $1,500. J. M. Moore, 425 Richmond street, is the architect, and the work will comprise a new plate glass front, wood panel work, and new fixtures.

Montreal, Que.

The architect, W. E. Doran, 189 Bleury street, will receive tenders for carrying out alterations, including the addition of one storey to a store on Notre Dame and Bisson street, for P. Wright. The work is estimated to cost about $3,000.

About the end of September the architect, Theo Daoust, 26 St. James Street, will call for sub-tenders in connection with the carrying out of alterations to the store on Jacques Cartier Square, for Alexander Desmarteau, at an outlay of about $30,000.

Ottawa, Ont.

A site with a 66-foot frontage has been purchased by Donald Fraser, 58 O'Connor street, who is contemplating the building of stores and apts. on Gladstone Ave., near Kent street.

Rossland, B.C.

The hotel belonging to Geo. H. Reen and Alex Smith, which was recently damaged by fire, is to be rebuilt at once at an estimated outlay of $10,000.

St. John, N.B.

Work has again been started on the construction of a $40,000 car barn on Wentworth street for St. John Street Railway Company.

Toronto, Ont.

The Toronto Housing Company has asked permission from the Board of Control to erect six stores on Bain Avenue in connection with their housing scheme. The matter has been referred to the City Council.

Work is to start on the construction of a dairy building and stables on Walmer Road and Bridgman street for the Farmers' Dairy Company, 367 Queen St. W. Symons & Rae, Sun Life Building, are the architects. Tenders for construction work are not yet opened.

Vancouver, B.C.

The National Mercantile Company, 739 Hastings Street West, is contemplating the construction of an office building on Hornby Street, to consist of two storeys and basement. The site has been purchased.

The City Council is considering the question of making alterations to the market building on Main street. Wm. McQueen is the clerk.

Victoria, B.C.

The Imperial Oil Co., Ltd., 404 Abbott street, Vancouver, has requested the city's permission to erect a storage plant at Victoria, to consist of warehouse, office building, pipe lines and storage tanks.

CONTRACTS AWARDED

Calgary, Alta.

The sub-contract for the brick work in connection with the construction of a grain storage elevator for the Dominion Government Department of Public Works, at a cost of $750,000, has been let to the Calgary Brick & Supply Co. The work comprises a storage tank building, 178 x 200 feet and 104 feet high and the workhouse. The general contractors are Janse Bros., Boomer, Hughes & Crane.

Fredericton, N.B.

The general contract for the construction of a wholesale feed and grocery store on Westmoreland and Queen streets for J. V. Johnston, 248 Smythe Street, and H. G. Kitchen, Woodstock Road, has been given to Thomas Myles, St. Mary's, N.B. The contract for concrete blocks, etc., was given to Concrete Builders, Limited, Gibson, N.B.

Montreal, Que.

The contract has been awarded to the Peter Lyall Construction Co., Limited, Montreal, for the construction of the new Strachan bakery at a cost of approximately $150,000.

Maisonneuve, Que. (Montreal)

The sub-contract for stone and brick work in connection with the construction of a two-and-a-half storey fire and police station on Letourneau and Notre Dame streets, at a cost of $70,000, has been awarded to C. Lalonge, Maisonneuve, at $63,000. Mains & Dufresne, Ontario street, are the architects.

Ottawa, Ont.

The contract for additions to stores on Wellington street for Mrs. Jane Byers, has been awarded to James Burke, 263 Breezehill. The material will be stone foundation, brick veneer construction, electric lighting, store fronts and fixtures, etc.

Additional contracts have been awarded for alterations and additions to a bakery on St. Albion street, for Jas. M. Aird, to the following: general contracting and plumbing, B. G. Loomis & Sons, Montreal; steel work, Phoenix Bridge & Iron Works, Montreal. Tenders for roofing are also in.

Toronto, Ont.

The general contract for the erection of an $18,000 addition to a garage on Avenue Road for the Wolseley Motor Car Company, 81 Avenue Road, has been let to Page & Company, Queen's Park. The new building will be brick construction, felt and gravel roofing. E. J. Lennox, 164 Bay street, is the architect.

Residences

Hull, Que.

J. Grenier, 14 St. Henri street, has obtained a permit for the construction of a two-storey brick residence on Catherine West, involving the expenditure of $2,500.

Montreal West, Que.

The general contractor, W. H. Payne & Company, 62 Westminster Avenue, will take prices on electrical work, plumbing, heating, and roofing, about September 10th, in connection with the construction of two three-storey residences on Percival for Mr. A. F. Packard, at a cost of $9,500.

Toronto, Ont.

Tenders will be called in two weeks in connection with the plastering, painting, heating, plumbing and electrical work on the detached residence, 527 Gladstone Avenue, in course of construction for J. H. Belford. The building is two and a half storeys, brick construction and foundation, shingle, felt and gravel roofing.

The City Council has issued a permit for the building of a $10,000 Rectory on Moscow Street, for the R. C. Church of the Holy Name. No contracts have yet been awarded for the building, which will be 2½ storeys, stone and brick construction, slate roof. J. A. Thatcher, 31 Queen Street West, is the architect.

Power Plants, Electricity and Telephones

Ayr, Ont.

A site has been purchased and the Town Council contemplates the erection of a hydro sub-station on McDonald and Gibson streets.

Lachine, Que. (Montreal)

The town council has awarded the general contract for an electric motor-driven turbine pump to E. Laurie & Company, Bleury street, Montreal, at $3,900.

The sub-contract for electrical work in connection with the alterations to the factory of J. C. Wilson, Limited, Craig and St. Alexander streets, at a cost of $29,990, has been let to the Beaver Electric Company, Montreal. Barott, Blackader & Webster, New Birks Building, are the architects.

CONTRACTS AWARDED

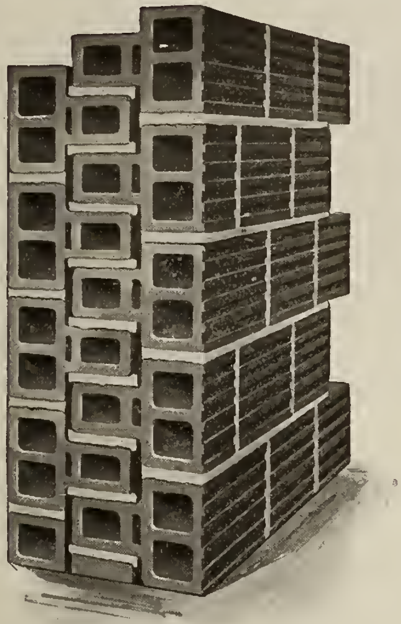
Toronto, Ont.

The Board of Control has awarded the contract for heating car barns at Danforth Ave. to F. Armstrong Co., 277 Queen street west, at $3,500. The concrete work has been sub-let to A. Gardener & Company.

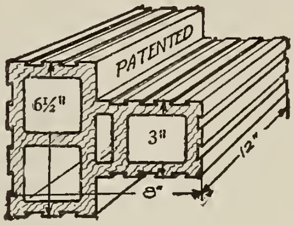
Messrs. M. Beatty & Sons, Limited, of Welland, Ont., pioneer builders of dredges and excavating equipment, launched recently from their shipyards on the Welland Canal another dipper dredge. This dredge is being built for the Randolph-Macdonald Company, Toronto. It will be of the boom and A-frame type, with a 3½ cu. yd. dipper to work in thirty feet of water. The steel hull is 107 ft. long with 36-ft. beam. It is 9 ft. 3 ins. deep at the bow and 8 ft. 3 ins. at the stern. The boiler is of the Scotch Marine type and is of ample size to furnish steam for the entire plant when working under heavy load. The bow anchors are made of steel plating with a circular reinforcement on the inside. All the sheaves and bearings as well as the anchor points are of open hearth steel castings. The builders expect to finish work on this dredge early in the fall.

DENISON

INTERLOCKING HOLLOW TILE



Twelve Inch Wall



It Interlocks.

The one size and shape builds all thicknesses of walls.

When Denison Tile is used the building possesses all the properties of a Thermos bottle.

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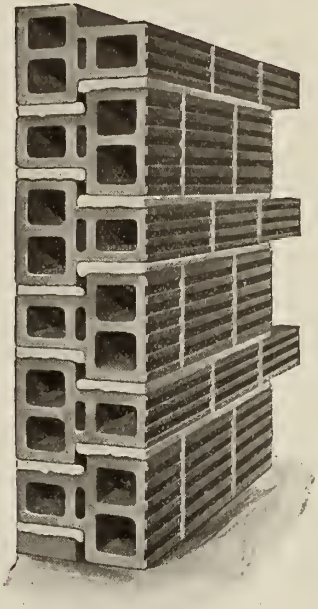
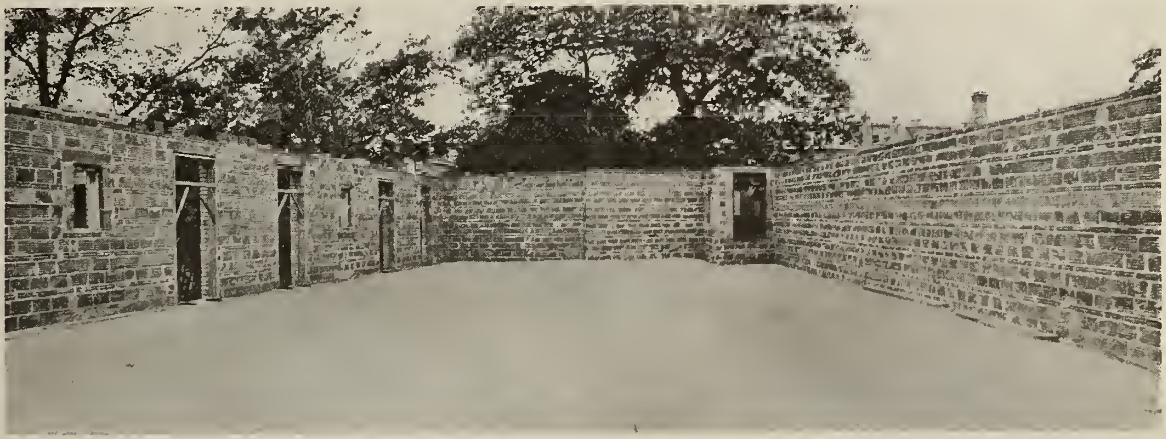


Eight Inch Wall



Apartment House at 392 Sherburne Street, Toronto, for Plewes & Storey

Wm. Fraser, Architect

Chas. Nobes, Masonry Contractor

Ask the Architect why he specified Denison Hollow Tile.

The One Price Company

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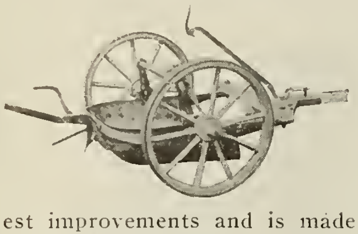
Alberta Pressed Bowl

WHEEL SCRAPER

No. 1

With Sand-Proof Iron Hub Wheels



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This scraper embodies, like our No. 2 and No. 3 Wheel Scrapers, all the latest improvements and is made out of the very best materials obtainable.

The bowl is stamped out of a single plate of the best steel three-sixteenths of an inch thick.

The Axle, Tongue Braces, Bail, Cross Truss, Lever and Hangers are of the best bar steel.

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Are furnished with End Gates, also with reinforced cutting edges if required.

Bowl holds 10 cubic feet, length 36 inches, width 35 inches, by 12 inches deep. Wheels 34 inches diameter, tire 3 x ¼ inches. Tracks 4 ft. 5 inches. Weight 400 lbs.

The Meaford Wheelbarrow Co., Limited
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Are furnished with any standard make of pump which we feel we can recommend. In case you have no preference, our engineers will choose a pump to fit the work. Our guarantee covers the whole set.

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Since the buckets are milled in the solid steel forgings there is no rotor trouble. The rotor does not shed its buckets periodically as a built-up rotor insists upon doing. In short, the STURTEVANT is the TURBINE THAT IS MADE TO RUN.

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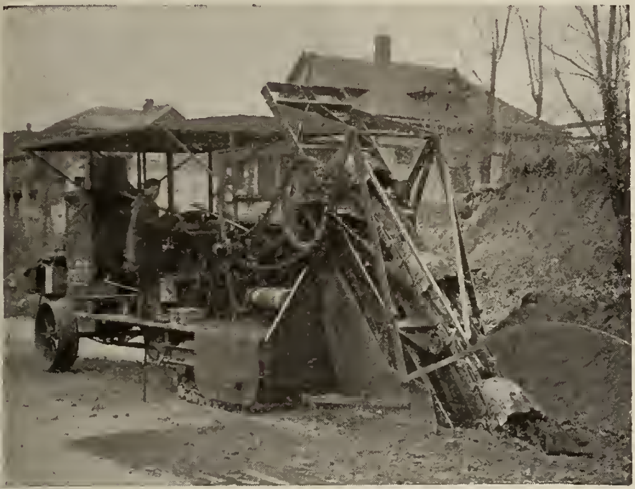
1000 feet a day for $1\frac{1}{6}$ cts. a foot total cost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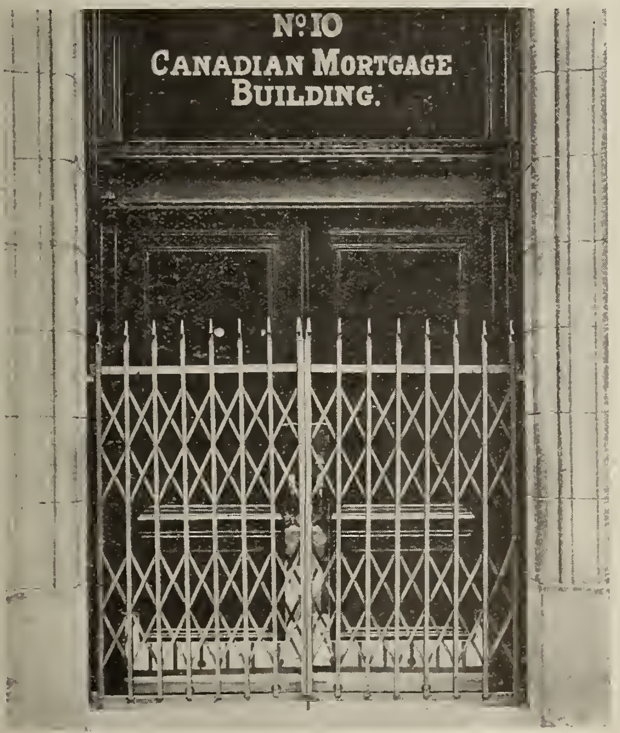

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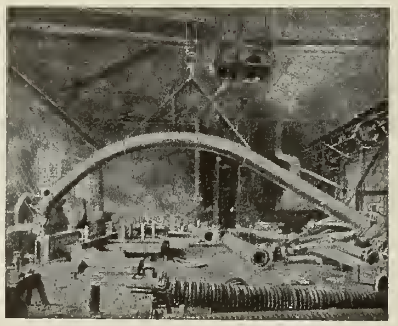

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eliminate heavy fittings
economize space,
avoid leaky joints,
save trouble, room and money

We make pipe bends in size and shape to meet your specifications. The cut above illustrates a 20 inch expansion bend of 16 foot radius containing 38 feet of pipe joined in the arc by the Atwood Line Weld.

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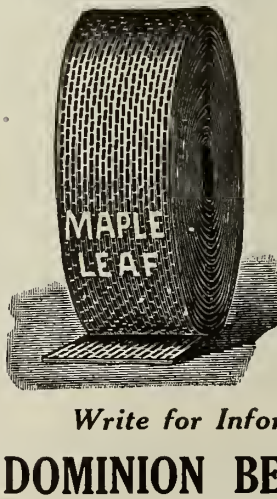

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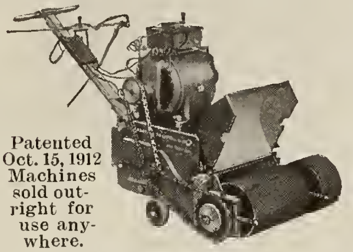

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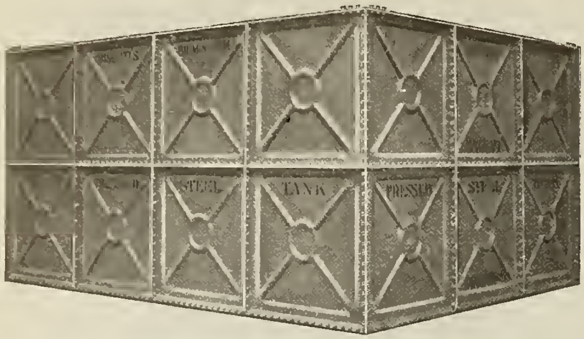

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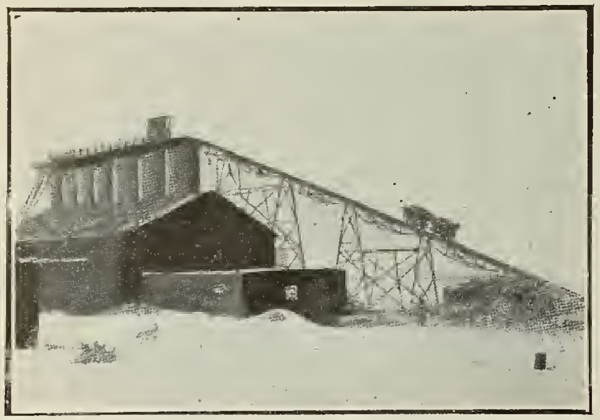

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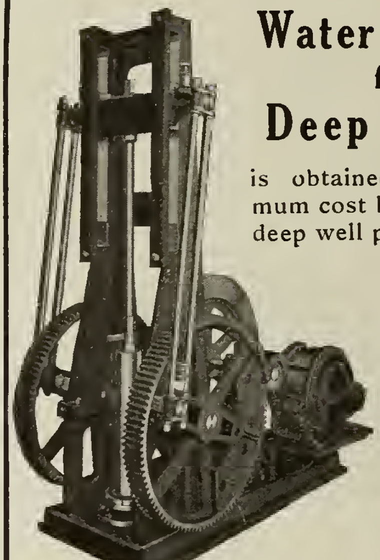

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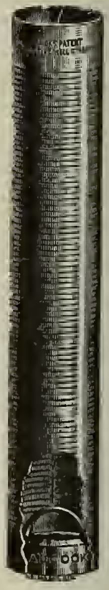

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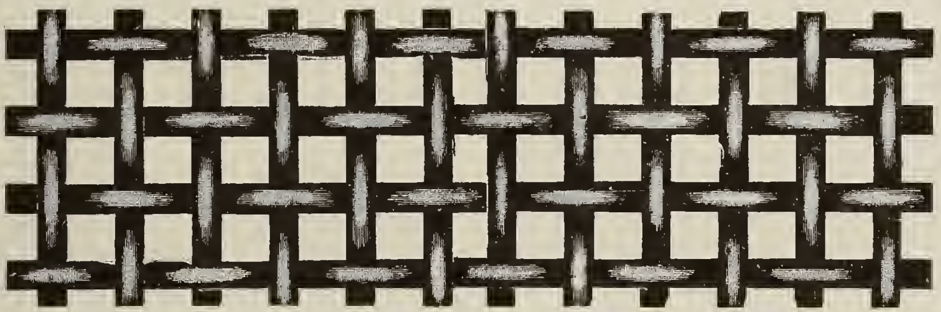

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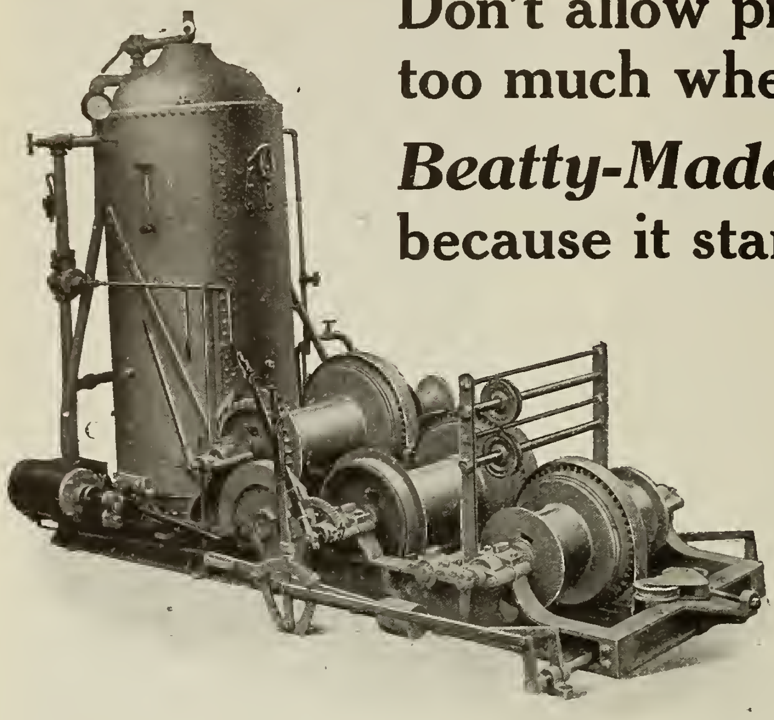

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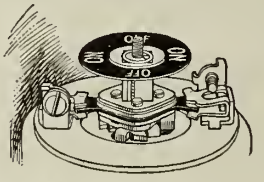
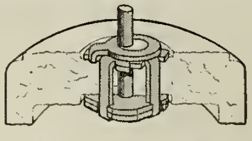
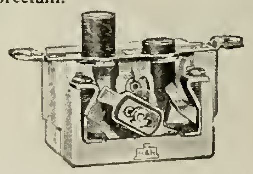


Heavy actuating mechanism with sleeve protecting spring.



Spindle supported by heavy base plates riveted together through the porcelain.



Simple mechanism with heavy single knife-type blades that always make good contact.

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SNAP SWITCHES

Heavy terminal posts and contact screws.
Single knife-type blades that insure good contacts permanently.
Spindles mounted on heavy base plates to take all twisting and bending strain from porcelain.
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Single knife-type blades.
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Towers and Tanks for all purposes.

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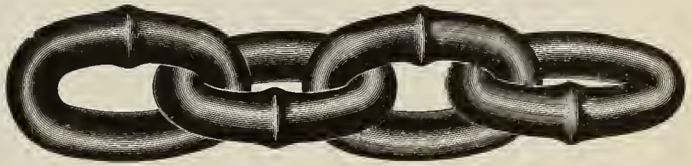

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Links per foot	6	5 1/3
Weight 100 ft.	410 lbs.	600 lbs.
Proof Test	13,000 lbs.	18,000 lbs.
Breaking Test	26,000 lbs.	36,000 lbs.
Working Load	8,000 lbs.	11,000 lbs.

Made in Canada × 25% Stronger × Sold by Jobbers

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NEPONSET Paroid and Proslate—the standard of ready roofings.

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FOR WALLS AND CEILINGS

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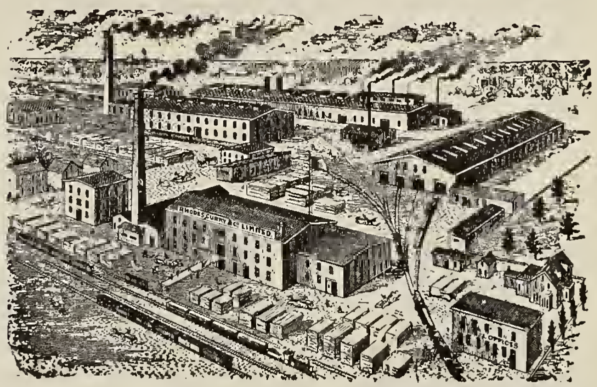

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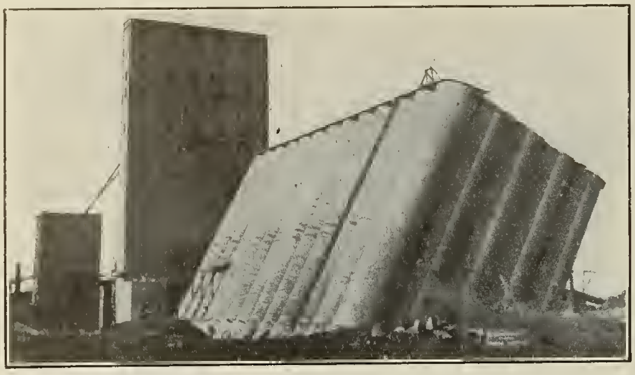

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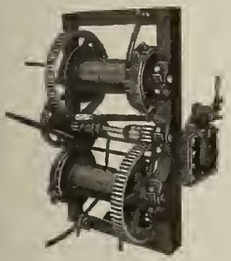
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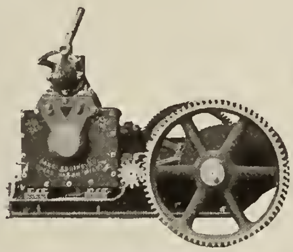
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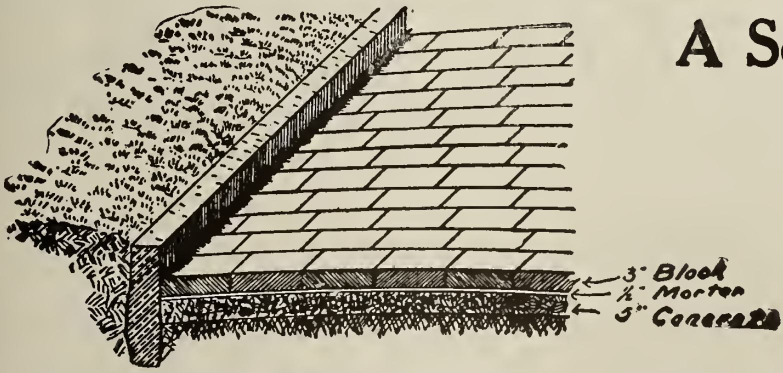

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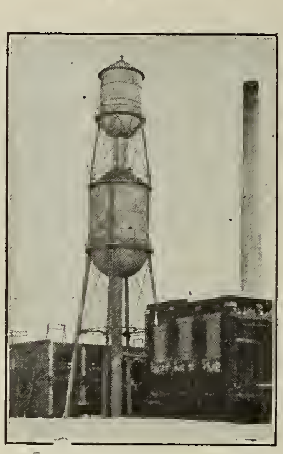

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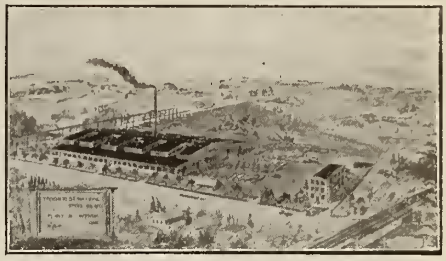
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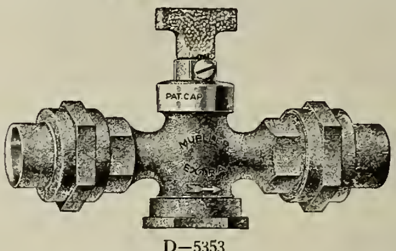

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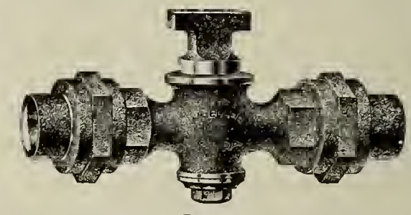

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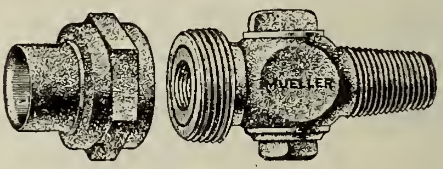

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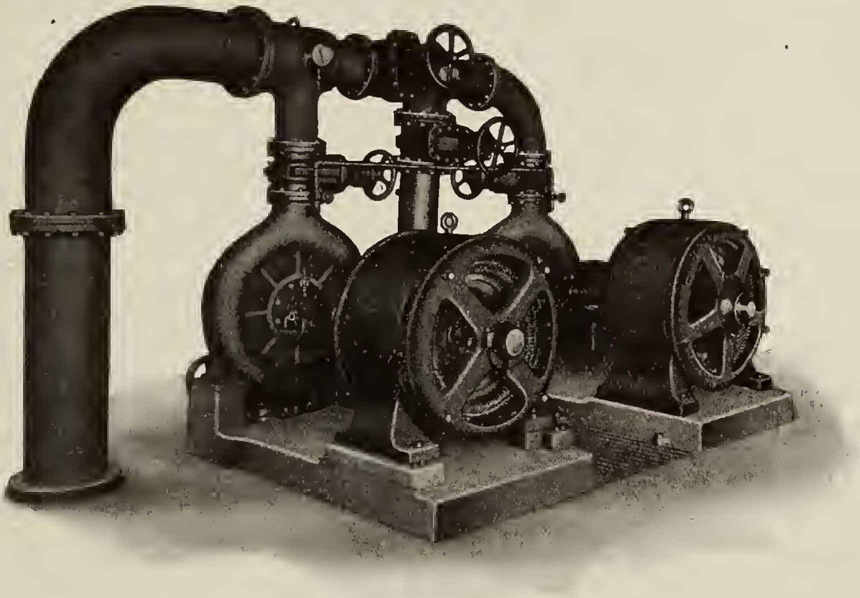

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Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $30; sand-lime brick, $8.10, King Edward Siding; $7 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M.

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Toronto prices, delivered:

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Gravel—$1.50 per cu. yd., delivered.

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Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

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Steel channels and beams, angles and plates—$4.

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Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

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Concrete Brick—grey $24, red $24, buff $25, white $47, plain pressed $12 per thousand, all f.o.b. Montreal. Quotations f.o.b. Toronto:—White $52.50, buff $30, grey $27.50, plain pressed $17.50.

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Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13c basis; African hemp, 13c; sisal rope 10½c basis. Boiled linseed oil—in barrels, 60c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, delivered, $13 per cord.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16,

(Continued on page 90)

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CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from p. 88.)

16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $8.85 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring. ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.15 to $3.65.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.15 to $3.65 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.00 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 90c per gal. of 9 lbs.

Raw linseed oil—in bbls., 88c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

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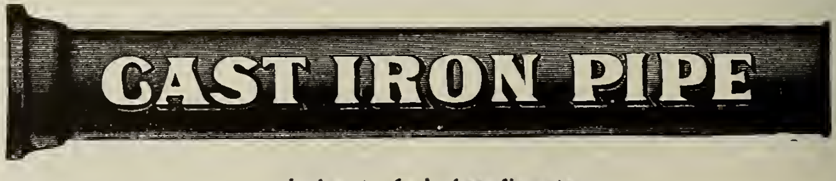

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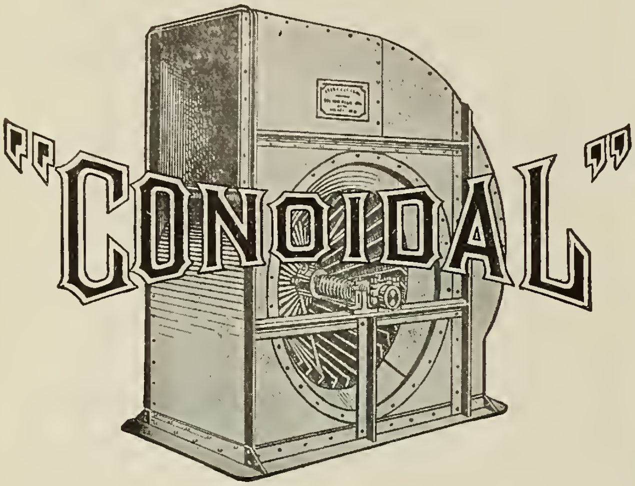

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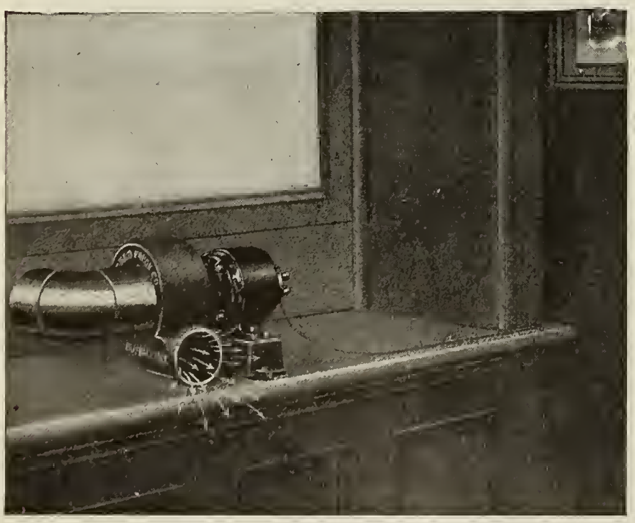

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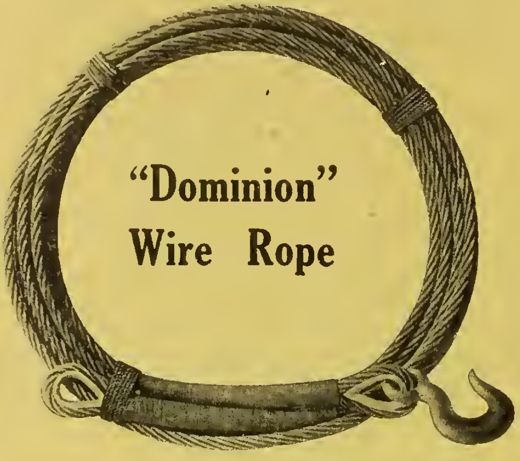

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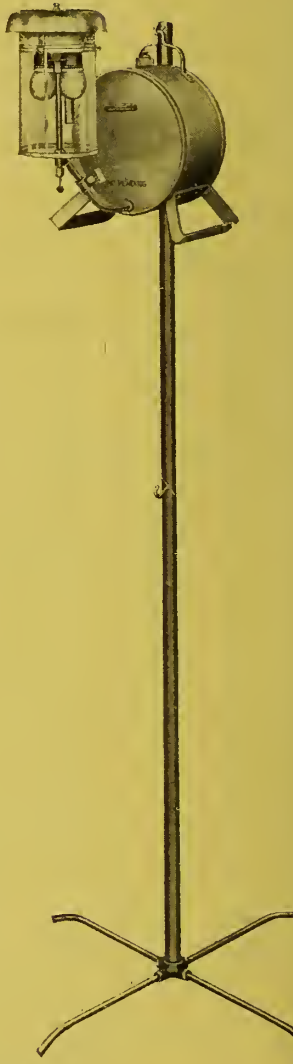
The "KING BEE" Gasoline Light

800 Candle Power



Requires no wiring—saves all expense—
Gives the same illumination as the strongest arc lamp at one tenth the cost.

Does not flicker—
Can be picked up and carried forward with the work—

Gets better service out of your workmen—
Costs less to operate and pays for itself in one month—

Rainproof and windproof—
No Glassware to be continually breaking—

Simple to operate—
Nothing to get out of order—

Well built and inexpensive—
COSTS FIVE CENTS TO OPERATE TEN HOURS.

We have placed a large number of these "King Bee" Lights with Contractors—Mining and Quarry Companies—Railroads, Etc. and they are giving universal satisfaction.

The "King Bee" is the ideal light for general construction work, steam shovels, Dredges, etc.

We supply CONTRACTORS' EQUIPMENT of all descriptions

F. H. HOPKINS & CO., **HEAD OFFICE MONTREAL**

Branches:—ST. CATHARINES, ONT. WINNIPEG, MAN. VANCOUVER, B.C.

Vol. 28 Toronto, September 16, 1914 No. 37

ESTABLISHED 1886

Contract Record and Engineering Review

Wood Stave Pipe

Galvanized Wire Machine Banded

Water Pipe

For City and Town Water Systems, Power Plants Irrigation and Hydraulic Mining

Reservoir Tanks

For Fire Protection, Etc.

Silos and Bored Conduit of Selected B.C. or Douglas Fir Stock

We take pride in handling only lumber that is clear, sound, free from imperfection. That is why our product gives entire satisfaction and we are supplying some of the biggest Irrigation Systems and Hydro Electric Work. May we estimate?

Pacific Coast Pipe Co., Limited

P.O. Box 563, VANCOUVER, B. C.

Office and Factory, Granville Street, near High Bridge

WRITE FOR CATALOGUE FULL PARTICULARS AND ESTIMATES FURNISHED

Alphabetical Index of Advertisers, Page 18 Classified Directory to Advertisements, Page 6

Gyratory Crusher

of modern design and equipped with an improved

Water Cooled Eccentric Bearing

This type of machine is made in many sizes with capacities from 5 to 1000 tons per hour and for any kind of rock.

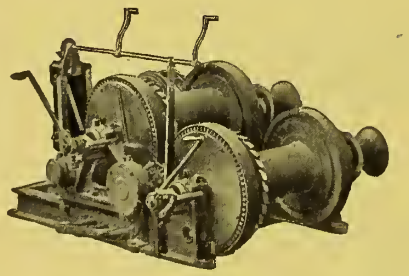
We also manufacture a full line of crushing, cement making, mining, hoisting, power rock drilling and air compressing machinery.

Write for full particulars

The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Toronto Montreal Cobalt South Porcupine
Halifax Vancouver and Nelson

"American" Electric Hoists



do electrically the same high-grade work "American" Engines do by steam. They have the regular "American" Frictions; powerful, easy to operate, cool running—can be adjusted to offset wear.

There is an "American" Electric Hoist to meet every hoisting requirement—heavy or light, fast or slow. They are made with from one to three drums. Load is under absolute control at all times and can be locked at any point.

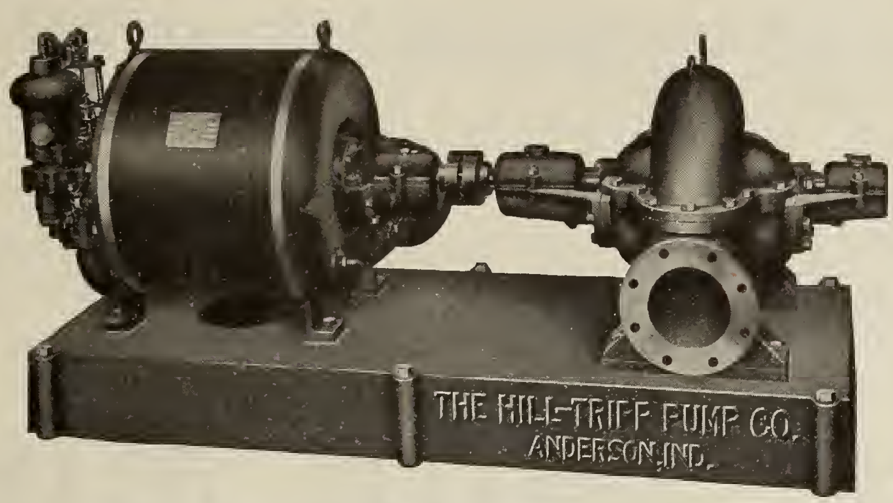
Motors are heavy type, variable speed and are capable of taking large overloads for short periods. The "American" Roller Ratchet prevents the load from dropping should the current suddenly fail.

American Hoist & Derrick Co
St Paul Minn.

Sold by General Supply Co. of Canada, Ltd., Montreal. Ottawa, Toronto.
Vancouver Machinery Depot, Ltd.,
Vancouver, B. C.

Stuart Machinery Co., Winnipeg, Man.
Gorman, Clancey & Grindley,
Edmonton and Calgary, Alta.

HILL-TRIPP CENTRIFUGAL PUMPS



High efficiency double suction impeller split case centrifugal Pump driven by direct connected Steam Turbine. Also arranged for Motor or Belt drive.

Hill-Tripp pumps have many superior features not found in other makes. By patented design of the casing and impellers all end thrust is eliminated. No high velocity water comes in contact with the casing. Impellers are non-overloading and the pump runs noislessly at all heads and speeds. The casing is split allowing access to the interior without disturbing the pipe connections. Built for all capacities and heads and with from one to six stages.

High efficiency is obtained by the special design of the Impeller, and this efficiency is maintained indefinitely and does not decrease with use as is the case with turbine pumps employing diffusion vanes.

All parts are interchangeable and made to limit gauges.

When quality of workmanship and cost of operation count, they have no equal.

Rock & Power Machinery

Limited

EXCLUSIVE CANADIAN AGENTS :

Head Office : 12 King Street East, Toronto.

BRANCH OFFICES: Vancouver Sudbury Halifax Cobalt
and in the King Edward Hotel, Toronto

Getting Concrete Results

Are you getting satisfactory work from your mixer?

Is the concrete up the standard?

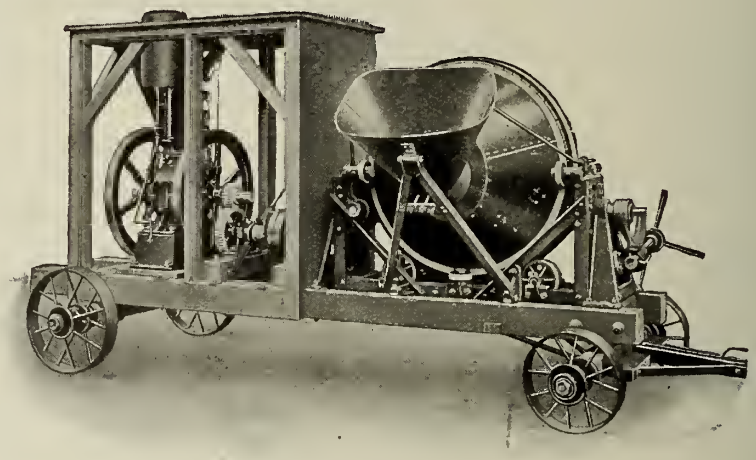
Is the machine standing up to the work?

The Smith Mixer

is the machine you can bank on.

The output will stand the tests.

Size for size no other machine will give you as large an output.



Strength, durability, convenience of operation, compactness and portability are all important features and are all combined in the SMITH.

Smith Mixers Never Fail.

Catalogue No. 45 on Request.

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley Street
CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

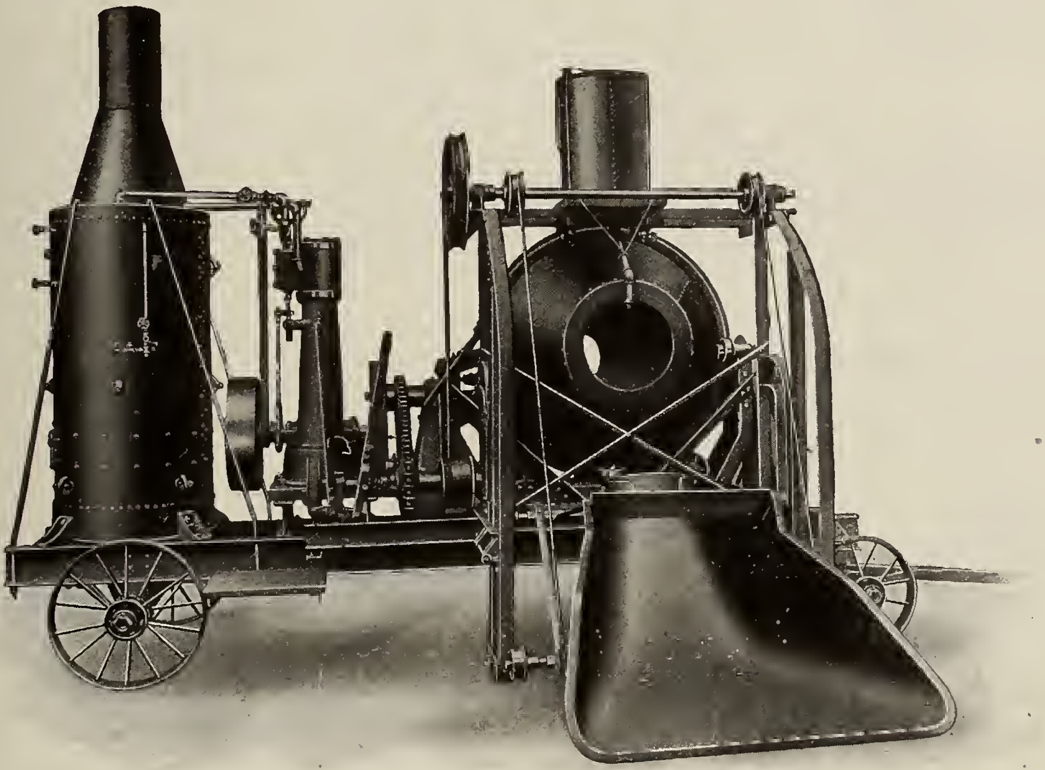
SECRETS of SUCCESS

The SMITH MIXER Mixes Naturally

The Duo-cone Drum with its interior blades produces perfectly mixed concrete.

The Tilting Discharge with the drum revolving, cannot be equalled for rapidity—it discharges the batch without separation.

The strength and durability are the outcome of the material and workmanship entering its construction.



Built Right ***Works Right***

Carried in Stock

Mussens Limited

MONTREAL 318 St. James Street
WINNIPEG, 259-261 Stanley Street
TORONTO, 155 West Richmond St.
CALGARY, 10th Ave. and 3rd St. East
COBALT, Opp. Right of Way Mine
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

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Hull Iron & Steel Foundries

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Can. Ingersoll-Rand Co., Ltd.
Jenckes Machine Company

Architects
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Aikenhead Architectural Iron Works
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Canada Wire & Iron Goods Co.
Dennis Wire & Iron Works
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Meadows Co., Geo. B.
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Boving Company of Canada
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Marsh & Henthorn
McDougall Caledonian Iron Wks.
Mussens Limited
Rock & Power Machinery

Boxes—Junction
Standard Underground Cable Co. of Canada Limited

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Canadian Sirocco Co.
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Sarnia Bridge Co.
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Manitoba Bridge & Iron Works
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Radigan Company, John
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Thew Shovel Company

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Richards-Wilcox Canadian Co.

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Canada Wire & Cable Co.
Northern Electric Co.
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Bremner, Alex.
McNally & Co., W.
Morrison & Co., T. A.
Ontario Lime Co., Ltd.
Smyth & Ryan

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Wadsworth Howland Co.

Cement Mill Machinery
Hull Iron & Steel Foundries
Jenckes Machine Company
Sutcliffe, Speakman & Co.

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Abram Cement Tool Co.

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McKinnon Chain Company

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Can. Yale & Towne Limited
Morris Crane & Hoist Co., Herbert

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Laurie Company, E.

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Galt Stove & Furnace Co.
Manitoba Bridge & Iron Works

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Browning Company
Brown Hoisting Machinery Co.

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Railway Contractors Supply Co.

Concrete Machinery
Canadian Zagelmeyer Co.

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Austin Drainage Excavator Company, F. C.
Badger Concrete Mixer Co.
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Dietrich Limited
Eastern Pipe Construction Co.
Foundation Company, Limited
Wells & Gray

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Canadian Locomotive Company
Canadian Brakeshoe Co., Ltd.
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Dake Engine Co.
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Honig & Mock
Hopkins & Co., F. H.
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Tiffin Wagon Works

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Golden Anderson Valve Co.

Conduits
Can. H. W. Johns-Manville Co.
Conduits Co., Limited
Orpen Conduit Co., Ltd.
Ric-wiL Underground Pipe Covering Company

Contractors' Flare Lights
Sudbury Construction & Machinery Company

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Sutcliffe, Speakman & Co.

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Rock & Power Machinery, Ltd.
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Cabot, Inc., Samuel

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Pedlar People

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Northern Crane Works

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Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis

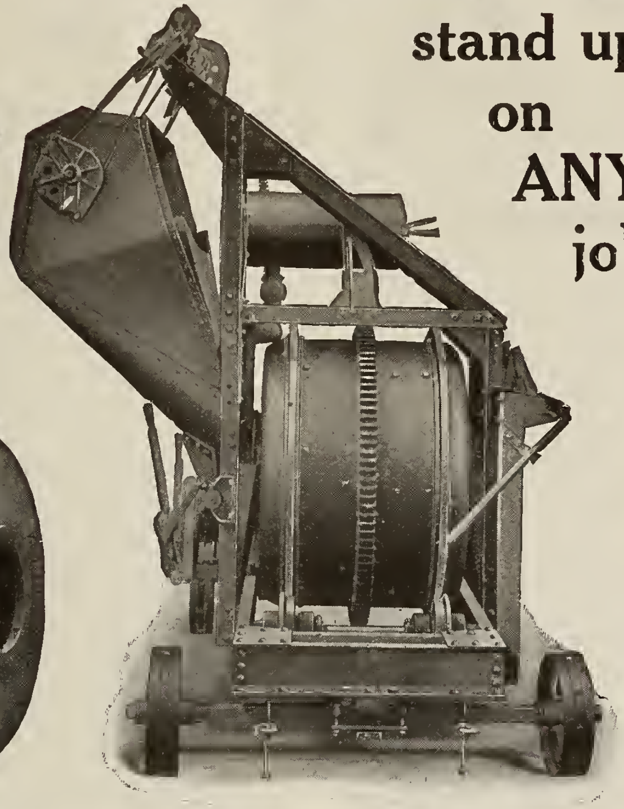
Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 12)

If a Mixer is built with Parts like These, it will stand up on ANY job

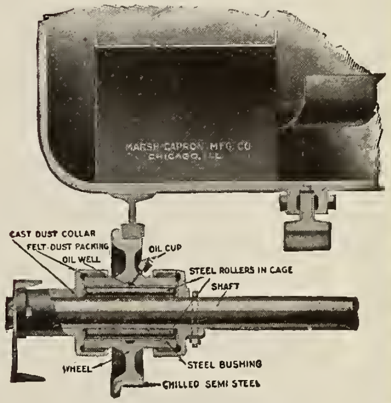
All-Steel Rail Tracks
The M-C is the only mixer fitted with real railroad tracks around the drum. These rail tracks are of standard rolled steel sections. They run true and wear four or five times as long as cast-iron rings.

Segmental Drum Gear
The M-C is the only mixer in which the main drum gear is built in segments bolted in place, to facilitate making repairs. If you have ever had trouble with a solid gear ring you will appreciate the advantages of this feature.



REAL RAILROAD RAILS
THE RAIL TRACK MIXER
MANUFACTURED BY MARSH-CAPRON MFG. CO.
FACE GEAR IS SEMI-STEEL MADE IN SEGMENTS
BEST KIND OF INSURANCE AGAINST DELAYS

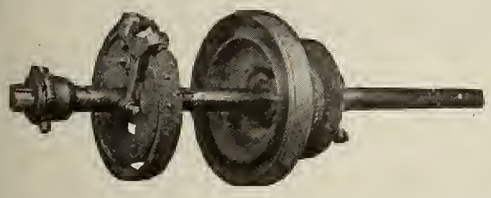
Cast Semi-Steel Drum
Made entirely of a high-grade semi-steel of great strength and toughness which offers maximum resistance to the severe scouring action of the sand and stone. A drum like this, more than half an inch thick, wears three or four times as long as a steel plate drum ⅛-inch thick.



Detail of Roller-Bearing Wheels
on which the M-C Rail Tracks roll. These wheels are of extra large diameter, are made of chilled semi-steel and are of the same type as used on cars in extremely severe mining service. They have heavy flange on one side, insuring straight, true turning of the drum regardless of its load.

The M-C
THE RAIL TRACK

Most Mixing—Least Fixing

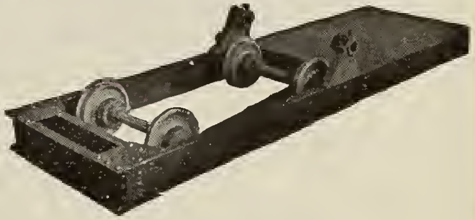


M-C Friction Clutch
The M-C is the only mixer using the steel-band-lined-with-wood-blocks type of friction clutch which is the only type of clutch which will stand the severity of side loader service.

Discharge Half of Drum
Extra large and heavy steel buckets. Reverse the discharge spout and any batch is completely discharged in from 15 to 18 seconds. No square corners or dead spaces where concrete will set.

Is The Only Mixer With The Exclusive Features Illustrated

Ask the Man who uses The M-C Mixer—he knows



Heavy Steel Channel Frame
held square by steel plates. No twisting or binding of this frame is possible, so the true alignment of the machinery is always maintained.

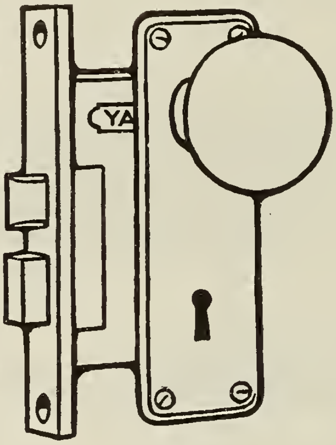
Charging Half of Drum
Highly developed, practical, proven arrangement of heavy steel mixing blades insures thorough mixing.

CANADIAN FAIRBANKS-MORSE CO., Ltd.
Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

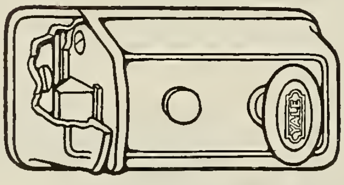
Manufactured by
Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

YALE

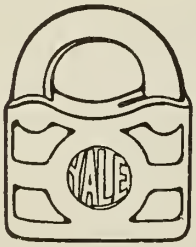
"The Mark of Quality and Efficiency"



YALE
Locks and Hardware



YALE
Night Latches



YALE
Padlocks

Yale Security
means safe buying

Security is a comparative term. *Yale* security is a superlative term. Discriminating Superintendents know this and are learning that a trustworthy name in locks is a safe name in hardware — that Yale security means safe buying whether it be:

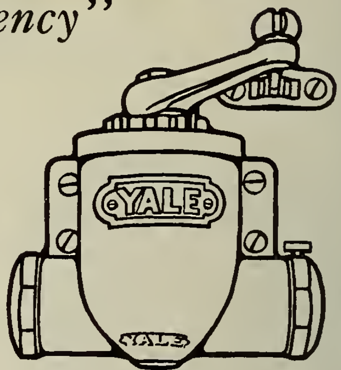
YALE Locks and Hardware
YALE Night Latches
YALE Cylinder Locks
YALE Padlocks
YALE Door Closers
YALE Trunk Locks
YALE Cabinet Locks
YALE Chest Locks
YALE Bank and Safe Locks

Almost any responsible hardware dealer can supply your Yale needs. A Yale dealer is a good man to know.

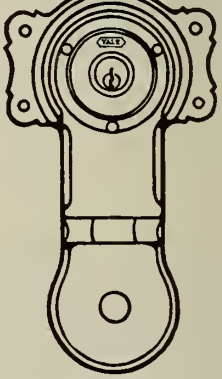
Write us today for booklets or catalogs on any Yale Product you are interested in. We will gladly supply you with detailed and interesting information.

Canadian Yale & Towne Limited

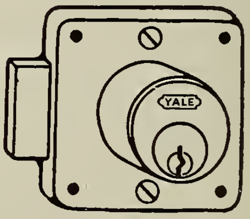
Makers of Yale Products in Canada :
Locks, Padlocks, Builders' Hardware and Door Closers.
General Offices and Works :
ST. CATHARINES, ONT.



YALE
Door Closers

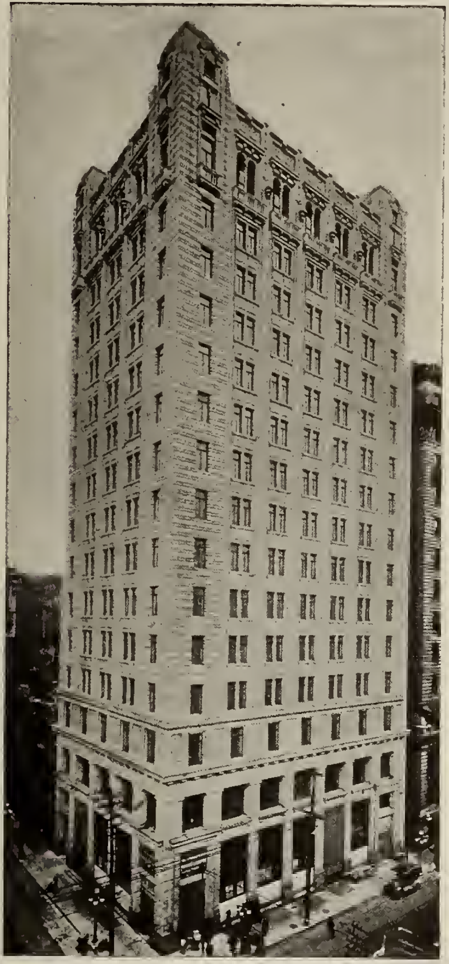


YALE
Trunk Locks

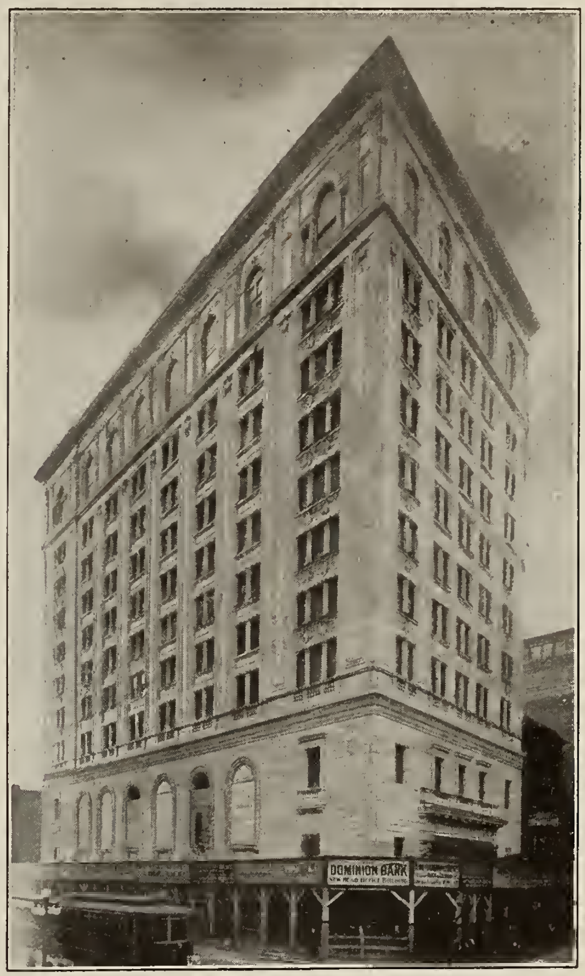


YALE
Cabinet Locks

THE NORTHWESTERN TERRA COTTA COMPANY



C. P. R. OFFICE BUILDING
Darling & Pierson, Architects



DOMINION BANK BUILDING
Darling & Pearson, Architect

Two prominent corners in Toronto

The Terra Cotta for both buildings was manufactured and set by

THE NORTHWESTERN TERRA COTTA COMPANY

Chicago - Illinois

Agencies in all the large cities of Canada.

Head Office and Works

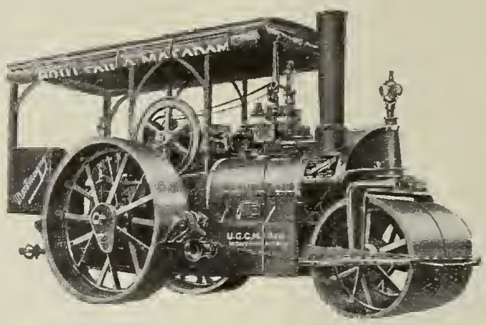
"Montmagny" Modern Road Builders

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The **"Montmagny"** line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



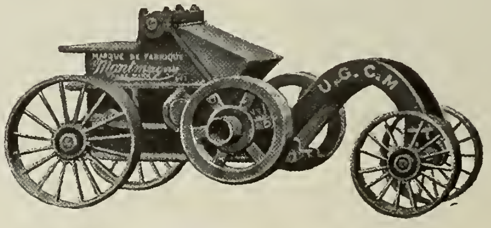
"Montmagny" Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

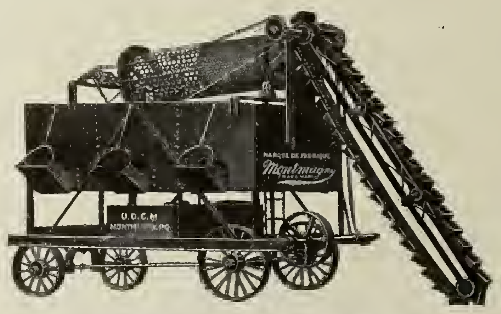
A great feature "Power Steering"



"Montmagny" Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.



"Montmagny" Portable Steel Bin.

Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

Quebec MONTMAGNY, P.Q., Can. Montreal

Aikenhead's

No. 408 Contractor's Forge

Full Line Blacksmith's Tools

This forge is very strong and durable specially adapted for general blacksmith work. It is equipped with No. 400 Blower, Whirlwind Tuyere Iron, and Half Hood, Hearth 30 x 36 in., Height 30 in., Weight 300 lbs.

Genuine Peter Wright Anvils and Leg Vises.

Aikenhead Hardware Limited, 17 Temperance Street
TORONTO

THE TURNER MUSHROOM SYSTEM

REINFORCED CONCRETE FLAT SLAB CONSTRUCTION

(Patented)

The recent decision of the Hon. Chas. A. Willard in the U. S. District Court of Minneapolis in the Drum vs. Turner concrete patent case sets at rest pretended claims of Mr. Turner's imitators.

All infringers are being rigidly prosecuted, as Mr. Turner has in his employ at the present time five of the best known and most able firms of patent attorneys in the United States.

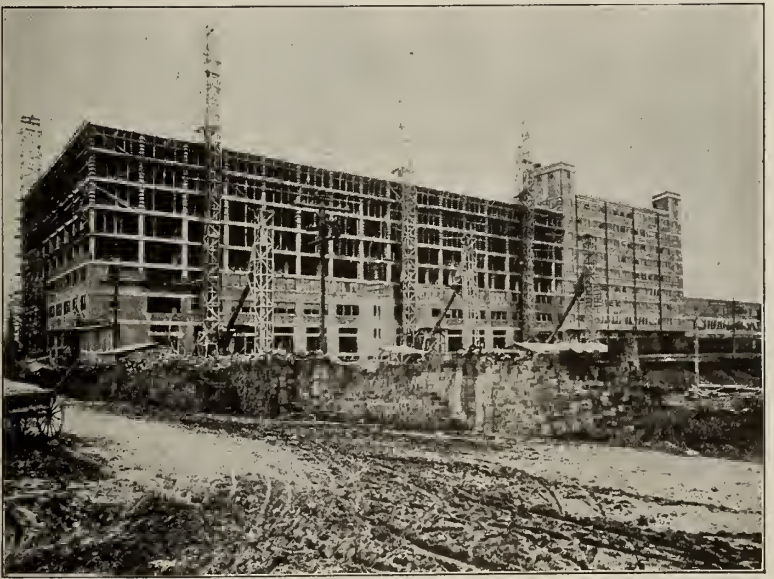
OWNERS, PROTECT YOUR OWN INTERESTS by demanding that your flat slab designers furnish an infringement bond of an amount equal to the cost of your building. Demand a bond for a five-year term and make yourselves safe.

THE MUSHROOM SYSTEM

is the original reinforced concrete flat slab system and is the only legitimate flat slab on the market today.

For designs, estimates and suggestions embodying the best of our long experience, you have only to consult our Engineers, without any obligation on your part.

Make the Concrete construction in your building secure by utilizing the long experience, right design and efficient service behind the Mushroom System.



View of Sears-Roebuck Company Building, under construction, Dallas, Texas

C. A. P. TURNER
M. Can. Soc. C. E.

Consulting and Contracting Engineer
Main Office: 6th Floor, Walker-Burton Bldg., Minneapolis, Minn.

Canadian Offices

Winnipeg, Canada
1005 Lindsay Building

Calgary, Alta.
312 Leeson & Linehan Building

Vancouver, B.C.
424 Vancouver Block

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Drop Forgings
  Canadian Billings & Spencer, Ltd.

Dump Cars, Wheels, etc.
  Bechtels Limited
  Manitoba Bridge & Iron Works
  Schell Foundry & Machine Co.
  Sheldons Limited

Dump Carts and Wagons
  Deere Plow Co., John
  McNally & Co., Wm.
  Troy Wagon Works

Drying Apparatus
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  Morris Hoist & Crane Co., Herbert.
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  Royce Limited

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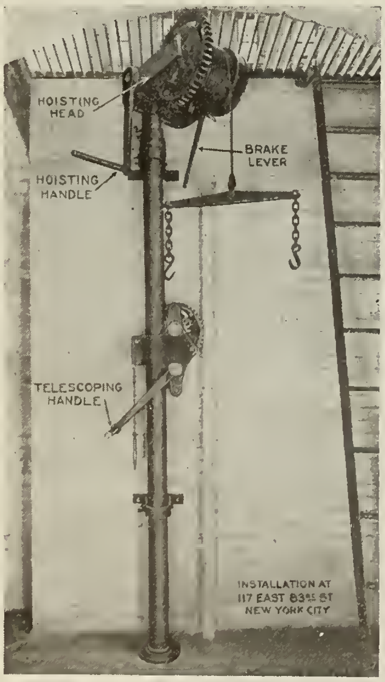
G & G TELESCOPIC HOIST (PATENTED)



Compact—easy to erect. Takes up no room in basement.

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.

1.—It is telescopic—no part showing above sidewalk when not in use.
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7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

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If you are not using
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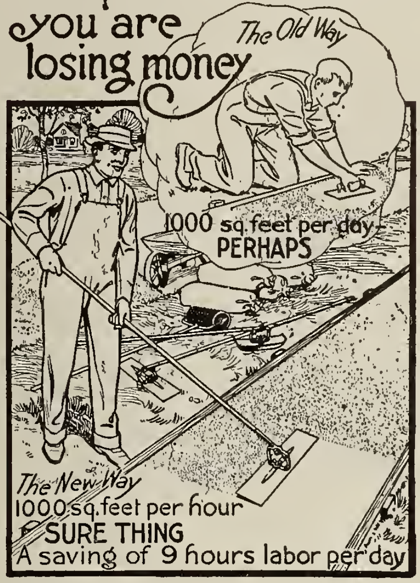
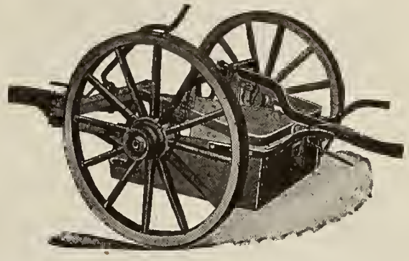


Abram Cement Tool Co.,
Windsor, Ontario

The Passing of the Shovel

in earth work. It is practically supplanted by

Western Wheeled Scrapers



Fewer men required. More work done in less time. Western Wheeled Scrapers are the original. None of the imitations are built so strong, have the many improvements, or are as durable and efficient.

Catalog gladly sent upon request.

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Earth and Stone Handling Machinery
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Macadam Roads

must be built of a

Tough Stone

that will cement

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High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

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"SUPERIOR GRAPHITE PAINT" (Gas Formula)

Prominent Gas Holder painted with Superior Graphite Paint (Gas Formula)

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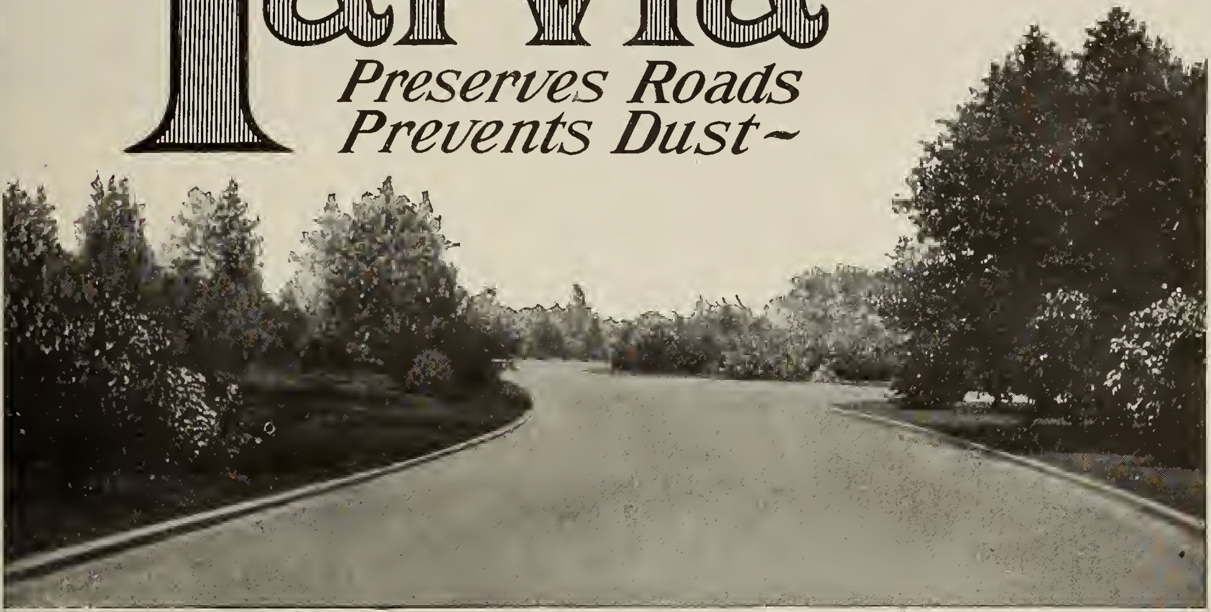

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A tarviated road lasts so much longer and needs so little care that the cost of the Tarvia is more than compensated for.

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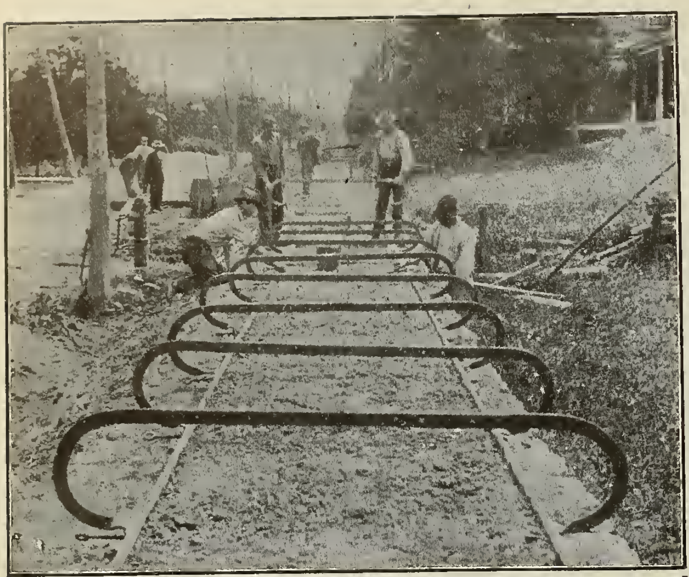

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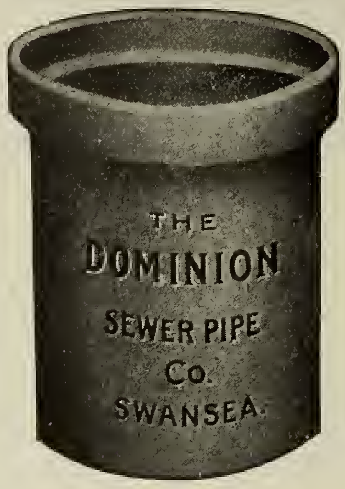

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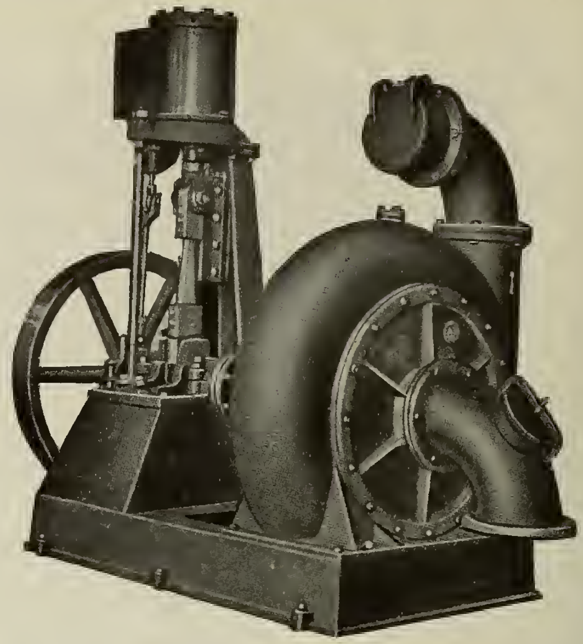

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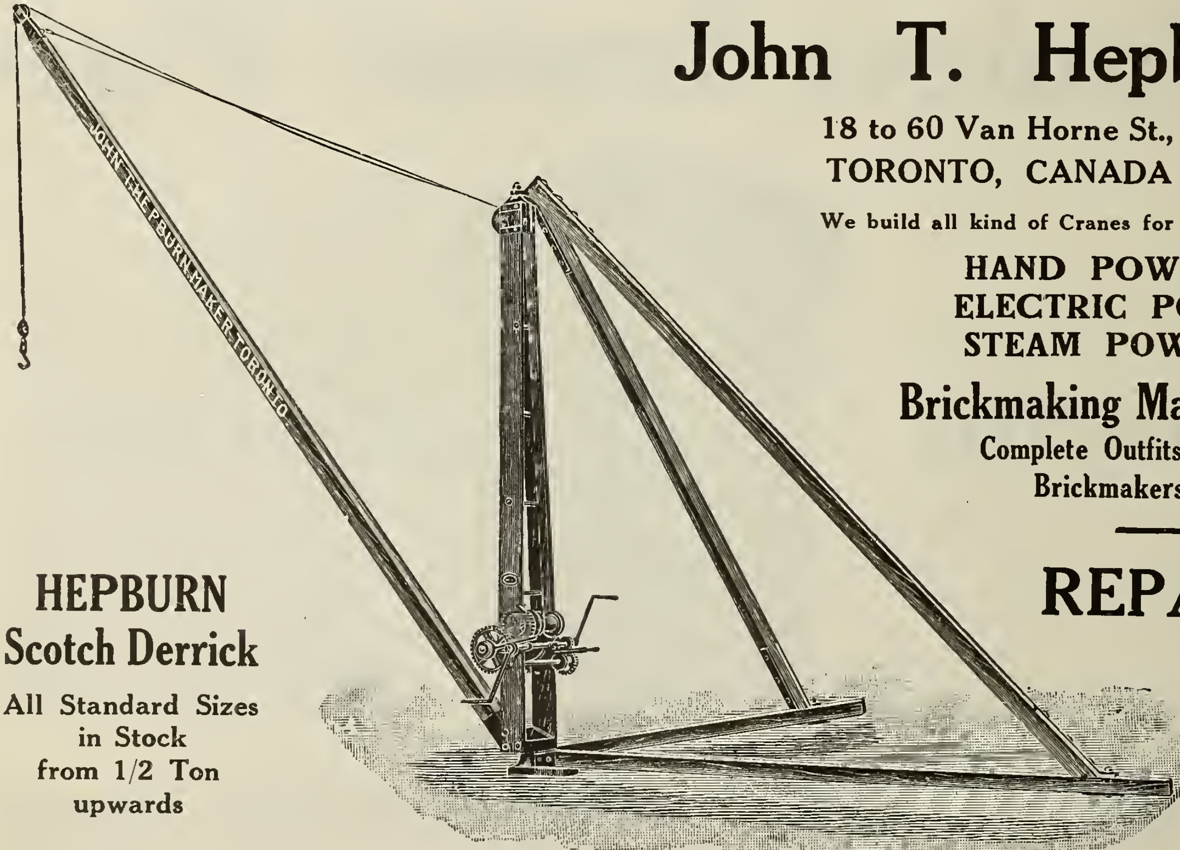
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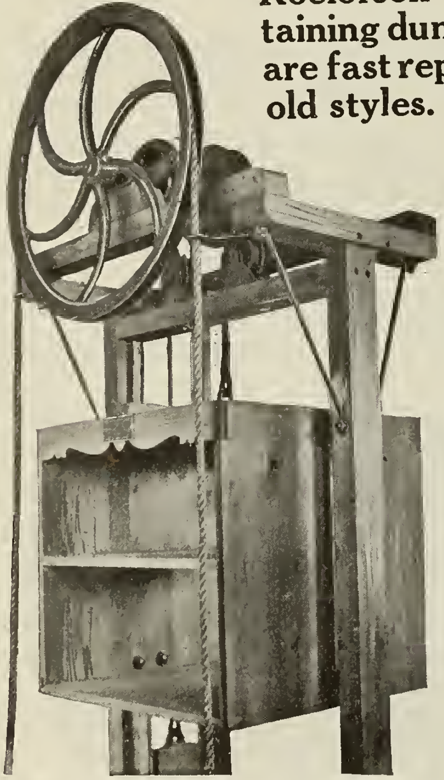

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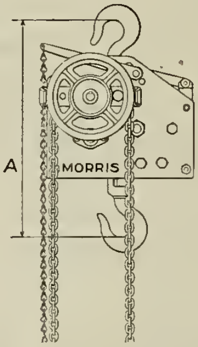

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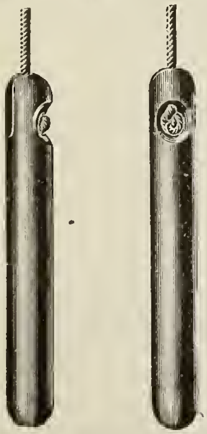

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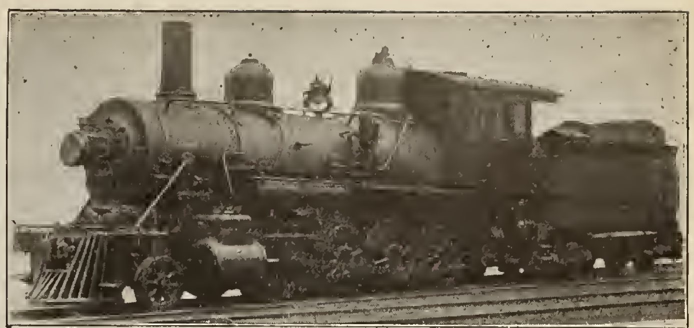

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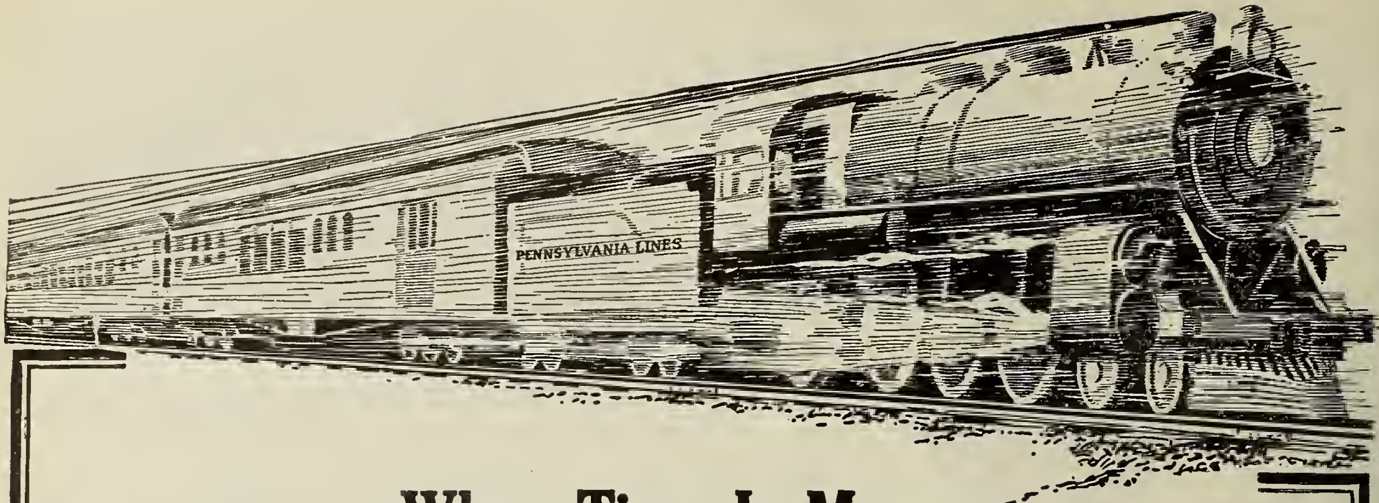

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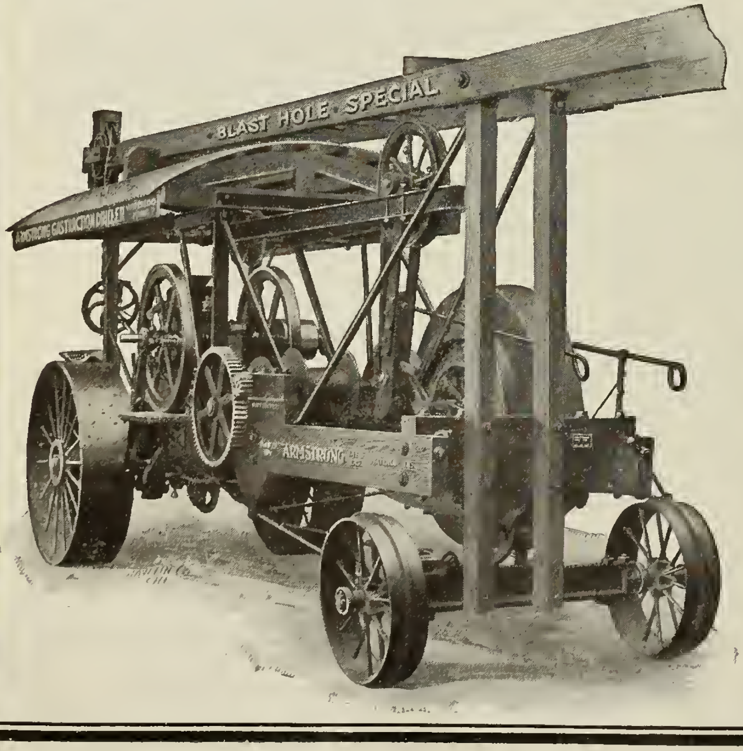

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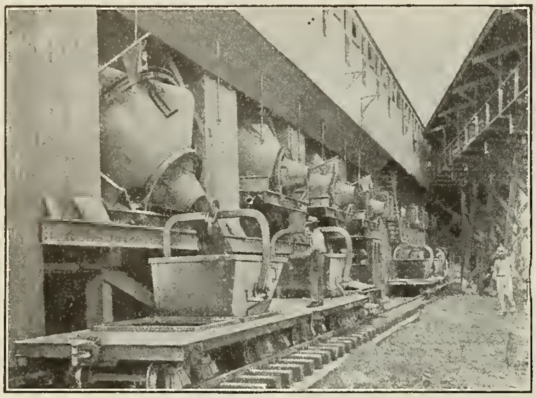

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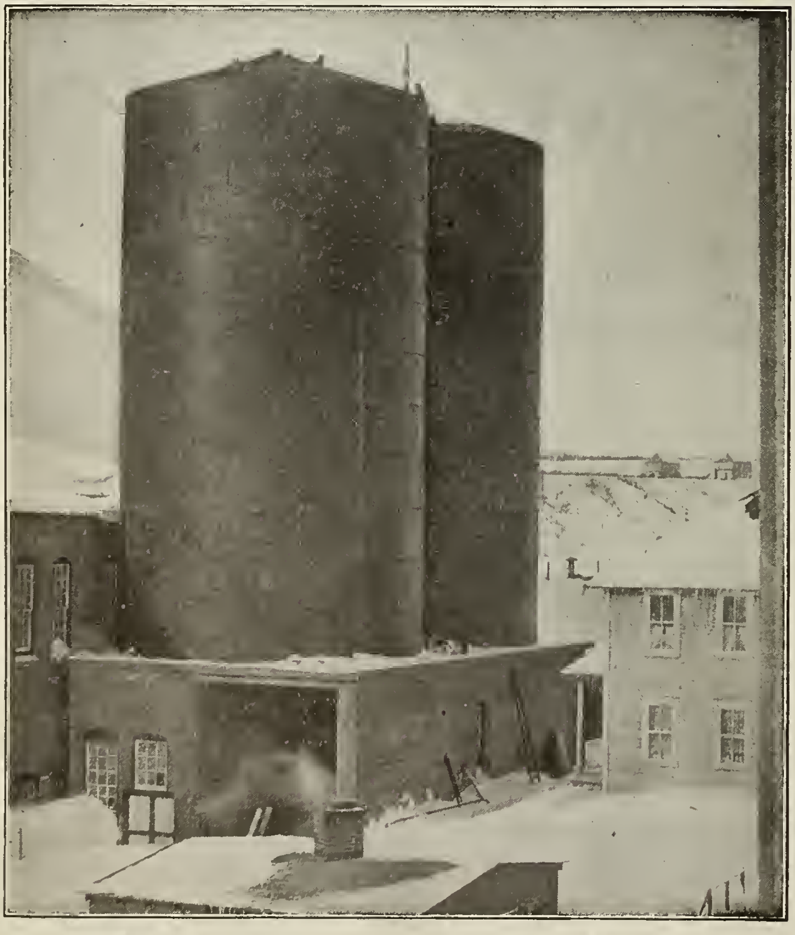

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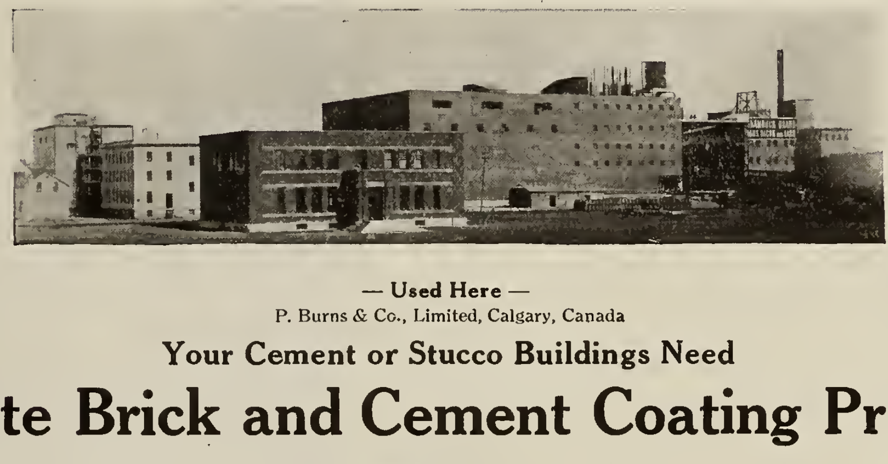

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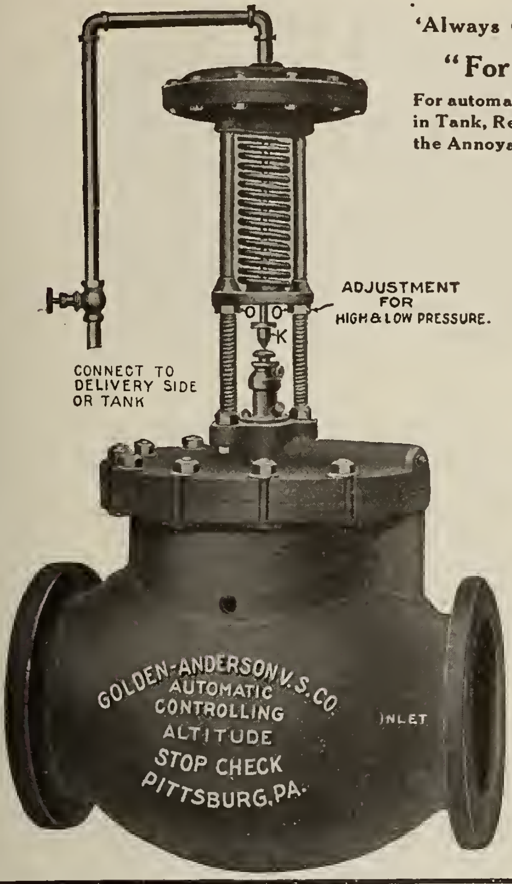

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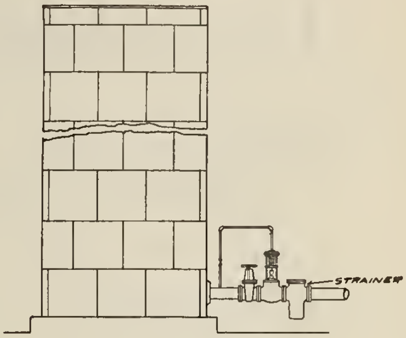

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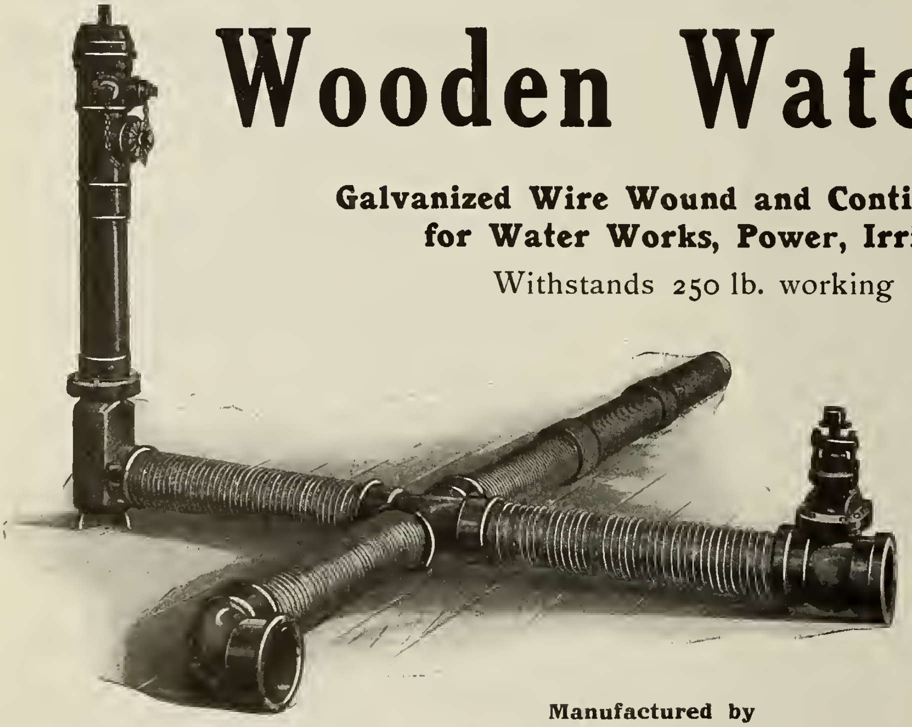

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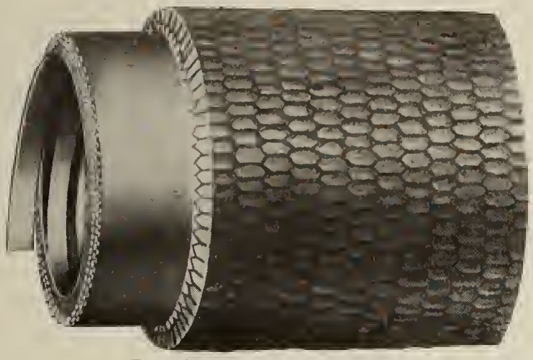

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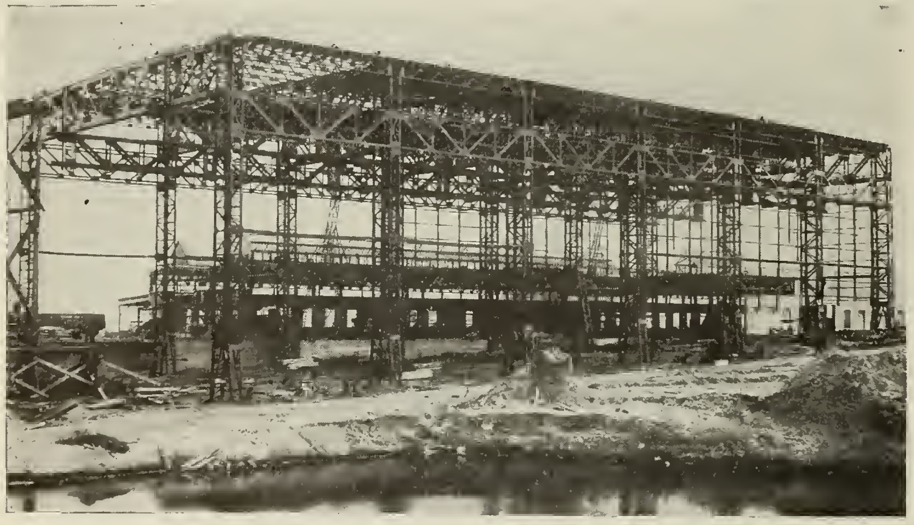

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"Business as Usual"

There is nothing particularly warlike in the slogan, "Business as Usual," but the principles for which it stands are playing a part in the affairs of the Empire second only in importance to the operations in the actual theatre of conflict.

The vast resources which make ultimate British victory certain were built up by men whose close attention to business was as productive for Empire as the dauntless courage of military and naval heroes.

Considering the present safety of trade routes, and having in mind the glorious achievements of British arms during the first month of the war, there is no ground for panic. There is every encouragement for work and confidence.

The general consensus of opinion is that this war will lead to the permanent advantage of British trade. In this advantage Canada must obtain a proportionate share. Events move quickly. Opportunity comes and is gone. Already British and United States manufacturers are concentrating their attention upon the chances afforded them of establishing themselves in colonial and neutral markets in certain lines of trade in which our enemies have hitherto transacted large business.

This is a time of testing. False steps at this juncture will imperil us individually and weaken us nationally in the commercial world. The qualities we must produce under test are perseverance, confidence, and stability. Perseverance will arise out of a determination to stick to the guns of commerce; confidence will assert itself naturally; stability will be maintained unconsciously.

The Dominion Government and other authorities have committed themselves to the policy of continuing public works. These public works must be supplemented by private enterprise. Sacrifice at such a time is unavoidable. It will be felt least if distributed evenly throughout the whole community. With factories running and constructional operations in progress, the sacrifice will be reduced to a minimum.

Engineers, architects and contractors—as men who control labor very largely—have a great responsibility to meet at this time. Clients disposed to abandon or hold off work unnecessarily may be upheld by intelligent argument inspired by confidence and the spirit of "Business as Usual." Every contract put in hand now, in addition to its particular value in providing labor, serves to increase the general measure of confidence; every contract postponed exercises a proportionately adverse influence.

That the pen is mightier than the sword has yet to be disproved. Time will show that commerce is the real ruler of the world.

To business—as usual!

Engineering Topics in the Old Land

The Responsibility of the Press in the Restoration of Commercial Confidence—Commendable Policy of British Government and Municipal Authorities in Providing Employment—Large Sums Available for Public Works—An Unparalleled Opportunity for the Manufacturing Interests

By the London, Eng., Correspondent of the Contract Record

London, Eng., Sept. 9, 1914

WITH a flagging interest in war bulletins, which all the fabrications of all the papers in the country cannot arrest, England is regaining her sanity. The seriousness of the war is recognized as keenly as ever, and anything like the truth is still eagerly sought; but the fourth estate has run past itself this time, and a day of reckoning is near at hand. The campaign of the respective allies has been put to the blush by the campaign of mendacity, falsification and invention at home, and the censorship which has been established (with a view, it was hoped, to the dissemination of the truth alone) has apparently sanctioned any item so long as it was false. Pain incalculable has been inflicted upon the friends and relatives of those upon active service, by the circulation of reports of decimated regiments, of huge landings of wounded, and of spurious combats. Small is the wonder that interest in bulletins (written largely in Fleet Street, and its purlieus) wanes day by day, and happy will be that time when the censor allows the truth, and the truth alone, to be printed, and the great Press of the country is thrust back into either sanity or bankruptcy, with the editors and other disseminators of false news safely under lock and key.

Trade and the Press

It may be argued that this tirade has nothing to do with the matter in hand—the effect of the war upon engineering and building construction in "the Old Land"—but it has the most important and most far-reaching influence upon it. Public opinion is both led and swayed by the Press, and there can be no full restoration of commercial confidence until scare news and catchpenny sheets are suppressed. The papers are complaining, and with truth (surprising to say), that their advertisement revenue is being reduced to nil. The "great" dailies are of course hit the worst, but the technical papers are far from escaping the undoubted slump. For this state of affairs, the former are almost wholly responsible. A newspaper is produced as a medium for the conveyance of news, of general news, of news which not only interests but is of real commercial and educative value. Such news does not exist. There are men who buy half-a-dozen papers a day, and who, after feverish consultation of the war "news" (there is nothing else) throw them one by one away. Such advertisements as do appear are simply not read, and it is a waste of money to insert them. When the war is given its due proportion of space and the life and doings of the community once more receive their due proportion, advertisers will renew and confidence will be restored. Until then, the slump must continue, and the best directed activities will fail of their full effect.

Government Sanity

Happily, sanity permeates the Government Departments, and a good augury may be drawn from the modest demeanour of the War Office in Whitehall. Here is no exhibition of bunting—not a flag waves—and the doors are guarded not by soldiers with fixed bayonets or anything of that kind but by two or three sober, stolid policemen. There is no rush, no hurry, no bustle, no show; but the work is being done and full well, too. In no direction has the Government evinced its sanity more plainly than in its recognition of the fact that, as there must be considerable distress in the country due to unemployment, it would be absurd to spend money in giving relief to those out of work when useful work itself could be provided. As regards building, the men are to be set to work in their own trade in the making good of the deficiency in housing accommodation, and a scheme embracing the expenditure of £4,000,000 is to be proceeded with without delay. As is only too well known, housing accommodation in rural districts is wofully deficient, and the good done if the scheme is carried out in its entirety will prove a valuable set off against the evils of a terrible war. The Development Commissioners have funds of nearly £1,000,000 as yet unallocated, and they are prepared to deal swiftly with any scheme submitted to them. So far as the fund itself is concerned they are unable within their statutory authority to deal with any applications for grants or loans to companies trading for profit or to individuals, but they invite suggestions, especially with regard to works of improvement connected with agriculture and rural industries (including afforestation), fisheries and fishery harbours, land drainage and reclamation, inland navigation and light railways.

The Local Government Board

The Local Government Board, too, has been doing great things. The writer has not the complete official figures before him, but there is no doubt that the number of inquiries held with a view to the granting of powers to borrow has been very large. Particulars have been gathered by him of some 97 inquiries, held in August alone, involving a total amount of considerably over £500,000 and covering works of sewerage, sewage disposal, refuse destruction, water supply, private street construction, electricity supply, paving, road widening and improvement, town planning, housing, sanitary conveniences and baths; the laying out of cemeteries, parks and recreation grounds; the extension of office buildings and town halls; and many others. Here we have in all now some £6,000,000 to be expended on works of a public nature alone, and it is pretty certain that the hope of the First Commissioner of Works, "that private individuals, companies, firms and contractors will spare no effort to follow the policy of the Government so far as circumstances admit," will be realized. Numbers of local authorities, urged on by the Local Government Board, have already held urgency meetings and have decided to carry out extensive works in the direction of those set out above, from which it is obvious that thousands of men who have been thrown out of work owing to the cessation of other industries will have the opportunity for full employment. The temporary arrest of the building trade dispute means the resumption of a wide field of activities, and it has been said that the strike was a blessing in disguise owing to the large amount of arrears which have been left to be made up now.

The Great Opportunity

What will be the ultimate result of the war upon the trade of England it is hard to foresee. The State is giving much assistance to the commercial interests of the country and everything that is possible is being done in that direction for the expansion of British commerce. But success or failure, as the case may be, rests after all with the individual manufacturer and trader. He has an opportunity now which he never had before. The competition of Germany and of Austria-Hungary is a negligible quantity even as regards neutral ports. Trade routes for England are comparatively safe, war insurance premiums have dropped, and the full continuance of business transactions has been rendered possible by the prompt action which the Government took on the outbreak of hostilities. It is for the Britisher now to pick up the business dropped by his foes (once merely his rivals) and this can be done only by energy and enterprise. Already far too many works have been prematurely shut down, far too many furnaces drawn. It is of the utmost importance that preparation be made for the boom that will follow the termination of the war, and unless work of every kind is as far as possible kept going England will be in but little better position than Germany, since both will have to start afresh. "The manufacturer," says the Financial Times, "faced with doubtful markets and uncertainty of credit, may well be tempted to shut down his works and wait for better times, rather than tempt fortune by launching out in new directions. From a patriotic standpoint, however, it is urged that the bolder policy should be pursued, and Government help might well be afforded to those who are in need of financial assistance to keep their mills and works going and are able to give reasonable security for eventual repayment." Enterprise is no longer individual; it is national; and work and not relief is what is wanted by the people. At such times as the present, good business is good patriotism, however much patriotism may be "good business" in the piping times of peace.

The Normal Course

Some scare was to be expected at first, and the voice of the dismal prophets of disaster was bound to be heard. Immediately after the declaration of war Lord Crewe said "there is no reason, so far as we are able to see, why the life of the nation should not pursue its normal course;" while Lord Lansdowne said, "it is the duty of every one of us, who has an opportunity of making his influence felt, to avoid any action which would have the effect of aggravating in any way tht general alarm and uneasiness which must inevitably prevail at such a moment as this." Unfortunately the Press, to which the ordinary individual (whose brain capacity is not very great) turns in untoward circumstances, aggravated in every way this "general alarm and uneasiness," and pursued any other than a "normal course." Even as regards construction its vision was limited to the erection of hospital accommodation for the wounded, such a thing as housing or the extension of public utility work being beyond its comprehension. Happily, it is finding its level, and the professional and business interests of the country are no longer jeopardized by its vapourings. National sanity bids fair to reassert itself, and with full restoration to health things should hum. There will, of course, be much destitution, and terrible destitution too; but it is possible to prevent its spreading to all classes of the population, and the bottom dog may be certain not only of sympathy but of material support if the nation "pursues its normal course."

Business as Usual

The following extract from a letter received last week from the London, Eng., Correspondent of the Contract Record and Engineering Review is significant and suggestive:

"A great deal of attention is being given in the daily papers here urging manufacturers to conduct their BUSINESS AS USUAL, and it would appear as if the campaign were to be successful. The country has certainly scored a 'silent' victory. Trade is booming already, and orders which would have been sent to Germany are being placed here."

LETTERS

The Deposit Cheque Upheld

Montreal, Sept. 9, 1914.

Editor Contract Record:

Dear Sir,—In your issue of August 19th there appears a letter regarding the practice of requiring a deposit cheque from contractors. This letter is signed "An English Reader." The views contained therein are so radical that it is small wonder the writer hesitates to use his own name. I feel that such views should not be allowed to pass unchallenged.

I have been engaged on a number of engineering works, large and small, both as engineer-in-charge and acting in the interests of the contractor, and have therefore had abundant opportunities to observe the question from both sides.

I am perfectly willing to admit that a deposit cheque may be a source of large expense and inconvenience to the tenderer, but such a condition is possible only when the engineer is lacking in the sense of fair play so much in evidence among members of the profession.

I know that many English firms object to being asked to put up an accepted cheque with their bids, but this practice is universal in the United States and Canada, and I have yet to hear of any American contractor who has found fault with such a procedure, as it is regarded here as one of the necessary formalities.

It may be that the moral tone of the English contracting world is so high that a deposit cheque is not required. An experience which I had a short time ago with the Canadian representative of one of the large English engineering manufacturing concerns would seem to indicate that this is not always the case. This firm submitted, through their agent here, a tender on certain apparatus. When requested to sign the contract, they refused, urging that their agent had exceeded his authority and had quoted prices which they could not sustain. Without a tender cheque the engineer and his client would have been put to considerable expense in arranging for material from other makers, and might have had to pay a considerably higher price in the end. In this particular instance, the writer was fortunate enough to get satisfactory equipment on short notice and at about the same cost.

The illustration "in plain English" given by your correspondent is quite beside the point, as it is grossly exaggerated. All specifications with which I am familiar state that the deposit cheque will be returned to the bidder upon the execution of the contract; or, if the contract be not awarded it will be returned within a specified time. Moreover, failure to execute a contract does not necessarily mean forfeiture of the cheque. Sometimes the balance is returned, after deducting the cost of a reletting, but more often a bidder is held responsible, up to the amount of his cheque, for any difference in cost between the original tender and the price at which the work is finally awarded.

There is no question but what accompanying a bid by an accepted cheque entails some expense on the part of the bidder, but it is a definite, legitimate amount and can be covered by the price bid. This requirement also operates to keep out the irresponsible bidder—a result which I think all will agree is a desirable one.

As long as human nature is what it is, and as long as there continue to be some contractors whose moral methods are open to criticism, a deposit cheque or bidder's bond will most certainly be required. It is the only way in which the engineer can protect his client against the loss of time and money consequent upon reletting a contract—to say nothing of the possible inability to get what is required at the price of the original tender.

I, for one, am firmly convinced that the deposit cheque plays a very important part in our present system of contracting, and I believe that the majority of Canadian engineers and contractors will agree with me.

Yours truly,
R. DeL. French,
Assoc. Mem. Am. Soc. C. E.
Assoc. Mem. Can. Soc. C. E.

The Problem of Cost Data

Montreal, Sept. 10, 1914.

Editor Contract Record:

I was interested in the particulars concerning the Ottawa River water supply project, published in your issue of September 9, but I notice that no costs were given. Generally I find your journal up-to-date in reporting constructional projects, but I feel that I must take this opportunity of emphasizing the value of cost data. If it is true that an engineer is a man who can do with one dollar what any fool can do with two, it goes without saying that he attaches primary importance to costs.

Yours very truly,
W. J. Richards.

Cost data have been a hobby with us from the time the first issue of the Contract Record appeared, but in this case theory and practice are two different things. In theory the Contract Record believes in publishing itemized cost data on constructional operations great and small, but it experiences no little difficulty in persuading engineers and contractors to furnish the necessary information. There is too general a tendency to regard cost data as stock-in-trade and to blanket the really helpful details affecting expenditure.

In dealing first with this aspect of our correspondent's letter, we do so because we desire to emphasize the high value which we place upon all material likely to be illuminative from the standpoint of cost. In regard to the particulars concerning the Ottawa River water supply scheme, we had already communicated with the authorities of the Federal Capital when our correspondent's letter arrived. The text of the reply from Mr. John Henderson, City Clerk of Ottawa, is as follows: "No detailed statement as to the cost of the proposed water scheme has been submitted. The public have merely been informed that the expenditure will be within two million dollars." We are indebted to Mr. Richards for enabling us to give prominence to an important detail.

The Economy of Wide Roads

By Thomas Adams*

THE advantage of wide roads is sometimes questioned. Where they are made in advance of requirements they may impose an extra burden on the existing ratepayers, for the benefit of posterity. This burden may be too great, even having regard to the ultimate benefit which may be derived, but of course this entirely depends on the degree of width and the extent of cost incurred. No definite standard of width can be satisfactory for adoption under all circumstances.

The ultimate economic gain to the community is one factor, but it is only one factor, in giving the matter consideration. The local circumstances may make it necessary for each road to be considered on its merits. The cost of expropriating land, the existence of buildings, the physical character of the site, the immediate gain as distinct from the prospective gain to the community must all be considered. There are, however, some general principles which afford us guidance in regard to these matters; for instance, where it is definitely known that a road will be required for use as a surface railway or tramway the width of the road should of course be greater than where such use is not contemplated.

There is no necessity for a road to be actually constructed in advance of traffic requirements. On that point there need be no difference of opinion. The sole question is whether the land should be acquired or earmarked for the road in advance of the full width being required. The investment made by the community to-day for the benefit of the future citizens may therefore be limited to the acquirements of the extra land. The construction can be spread over as long a period as may be desirable, but if the land is not purchased at the outset it may be assigned to private uses, such as the erection of expensive buildings, which would make it prohibitive to carry out the widening when actually needed. These possible losses and hindrances to the future development of a town must of course be considered, as well as the question of immediate gain, but the immediate gain, or rather absence of loss, probably makes the wider appeal to the ratepayers.

It is therefore of interest to have an example such as that afforded by the illustrations and figures I am about to give with regard to the construction of a wide road at Liverpool, England. The city engineer of Liverpool has made extensive experiments in the making of wide roads round the suburbs of the city. He is probably the ablest city engineer in the mother country. Recently he demonstrated to his council that it was cheaper to make a road 120 feet wide than 80 feet wide.

The cost of the two roads, 80 feet and 120 feet wide respectively, is given by the city engineer as follows:

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* Senior Advisor to the Local Government Board of Great Britain.

CITY OF LIVERPOOL
City Engineer's Department

Comparative cost of widening a 40-foot road to 80 feet (tramways paved) with widening to 120 feet, (tramways in grass).

Widening to 80 Feet

Cost of land, 13 1/3 yds. at 5s.	£3	6	8
Street works per yard lineal	£7	2	6
Tramways (including paving) 1 yd. at £6 15 ..	£6	15	0
	£17	4	2

equals £30, 286 per mile.

The above estimate includes for the reconstruction of the old road to suit new levels.

Widening to 120 Feet

Land for new road, 13 1/3 yds. at 5s equals ..	£3	6	8
Street works per yard lineal	£4	13	7
Tramways (in grass) including land, 1 yd. at £6 16 8	£6	16	8
	£14	16	11

=£26, 128 per mile.

This estimate does not include for any alteration to the old 40-foot road.

It will be observed that in order to make the 80-foot road it is necessary to reconstruct the old road to suit the new levels, but that no such reconstruction is necessary in the case of the wider road. It is also important to note that the estimate for the 120-foot road includes the cost of the extra 40 feet of land used for tramway purposes.

These circumstances are of course special to a certain extent. Instances might occur where the reconstruction of the old road would be necessary in either case. But even then the only extra cost per yard in making the wider road would be one-eighth the difference between £6 15 and £6 16 8, the cost per yard of the tramway.

In this case the important point is that it is much cheaper for the Liverpool corporation to make a road 120 feet wide than 80 feet wide. All the ultimate advantages to the city are therefore additions to the immediate gain. The latter, however, is not limited to the saving of cost. In Liverpool they are finding out that these wide tree-planted roads are having the effect of keeping the homes of the well-to-do citizens within the city boundaries. Those who will not erect large houses in narrow uninteresting tramway routes are building them on the spacious highways which Mr. Brodie is constructing. Liverpool has for a long time suffered from the migration of its large ratepayers into outside districts. This not only increases the rates all round in consequence of lowered ratable value, but removes from the city those who, while in residence, subscribe to its charities and take an interest in its social life. That the policy of making wide avenues with grass margins is helping to retain these well-to-do inhabitants within the city limits is one of the indirect advantages which Liverpool claims.

UNDER the auspices of the American Highway Association, a conference of women from all the States has been called to meet in Atlanta, Ga., November 10th, to consider ways and means of making the organized efforts of women most effective for the betterment of public roads. The programme includes a special demonstration of the government exhibit for the ladies in attendance at the Conference, upon which occasion the Director of the United States Office of Public Roads will be the host. A lecture illustrated by moving pictures will be given by Mr. J. E. Pennybacker, Chief of the Division of Road Economics.

Day Labor vs. Contract Work

MUCH municipal work has been carried out by day labor in western cities, but not always successfully or profitably. Strenuous objections to the system were brought forward by Alderman Hepburn of the Vancouver City Council recently, when the city engineer recommended carrying out considerable work by day labor. Mr. Hepburn decried day labor and stated that no more dishonorable transactions had been carried out by the city than recent decisions against contractors. In one instance the contractors were held up for two months and then the work was carried out by day labor. After that, the work cost $15,000 more than the contract price. Alderman Hepburn asserted with much reason that contractors were able to figure more closely than a corporation, owing to the advantages they obtained in the way of cheap quotations on cement and other materials. A member of the council supported Alderman Hepburn and outlined the many advantages that were associated with contract work, particularly the incentive to do the work economically and expeditiously. Civic employees had no personal concern with any additional expense. The contractor had. It came out of his pocket. In regard to expeditious work, a generous time limit on day labor was always understood and invariably exceeded. The greatest engineering and constructional operations in the world had been carried out by contract.

Good News from Winnipeg

FROM Winnipeg comes the cheering report that work is proceeding on all contracts with the exception of the provincial government jobs and the Ames-Holden building. The leading contractors are practically unanimous in saying that there has been no cessation of work on their various undertakings, which involve the expenditure of two or three million dollars. One firm has taken on four new contracts since the outbreak of hostilities, and another firm has actually increased the number of its employees. The local representative of Messrs. Geo. A. Fuller Company states that his firm has agreed to furnish the money for constructional operations at Edmonton on the University of Alberta. The Carter-Halls-Aldinger Company report that work has not been stopped on any of their contracts in Winnipeg and the west; and that, on the contrary, they have added to their staff. Among the large buildings which they have under way are the new drill hall in the west end, the addition to the Winnipeg Grain Exchange, the Quebec Bank and the Olympia building. At Calgary they have the new Merchants Bank building, and at Moose Jaw a large contract for the Canadian Pacific Railway. Messrs. Frid-Lewis & Company are proceeding with eleven contracts, four of which have been taken on since the war started. The Daykin-Scott Construction Company have two apartment houses and six residences on hand.

Methods Employed on the Substructural Work of the C.P.R. Harrison River Bridge, B.C.

THE double-tracking of the lines east from the Coast has necessitated the rebuilding of all the C. P. R. bridges. The foundations for the two largest of these, the Pitt River and Harrison River Bridges, have recently been completed by The Foundation Company, Limited. The old Harrison River Bridge, B.C., consisted of 425 ft. of standard C. P. R. trestle on the east side; one 127 ft. plate girder draw span, and four 100 ft. pony truss spans. The new bridge will consist of seven 70-ft. and three 80-ft. half deck girder spans, and one 176-ft. through girder draw span. The grade and alignment of the new bridge will be the same as the old.

The soundings showed that there were about 20 ft. of water at Piers Nos. 1 to 4 inclusive, and 22 ft. to 26 ft. at Piers Nos. 5, 6, and 7—the deepest part of the channel. Borings taken at the site of the piers showed fine sand, gravel and clay on the east side up to Pier No. 7. Here rock was found at Elev. 57.5 below extreme low water on the downstream end of the pier and 81 ft. on the up-stream end, showing a difference of 23.5 ft. in 60 ft., the length of the pier. At the site of Piers Nos. 8, 9, 10 and 11, the conditions were even worse. At the downstream end of Pier No. 9, rock showed up at Elev. 22.3 ft. and only 3.5 ft. of material overlying the rock, while at the upstream end rock showed at Elev. 57.3 ft., a difference of 26 ft. in 55 ft., the length of the pier. The material on the west side overlying the rock was a fine sand with a thin layer of clay and hardpan just above the rock. At Pier No. 11 the rock cropped out at low water but was 48 ft. below at the upstream end of the pier.

Work was started on the east side as the temporary changes required for handling traffic were more easily made when the water was high than on the west side where the pony trusses were moved and the drawspan taken out after navigation was closed on November 1st.

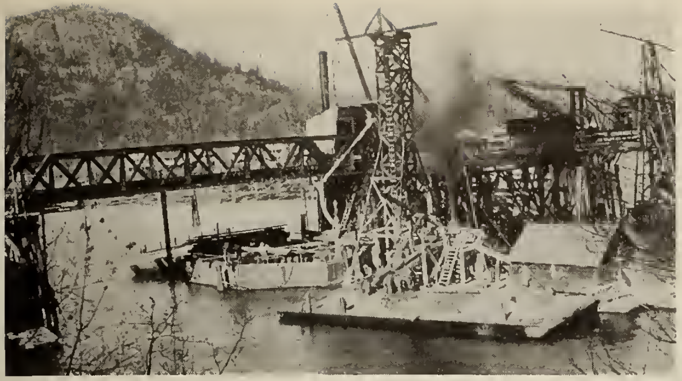
To make room for constructing the piers under the old trestle section, additional pile bents were driven 13 ft. either side of the centre line of the new piers and extra heavy stringers were used. These were six 15-in. x 30-in. x 26-ft. long. The change left two old pile bents besides a large number of stub piles, remnants of former trestles, inside of each cofferdam for Piers Nos. 1 to 5 inclusive.

General view of the Harrison River Bridge under construction.

Arrangement of Derricks

One derrick with 60-ft. boom handled the East Abutment and Pier No. 1 with one set-up. Another derrick on a platform or tower between Piers Nos. 2 and 3 handled these two piers. One between Piers Nos. 4 and 5 handled these two piers. Later a derrick tower was erected between Nos. 6 and 7. These were all on the downstream side of the bridge. On account of the trusses on the West end of the bridge, the derricks had to be raised to work over them. Owing to the fact that on the south side of the bridge there was very little ground covering the bed rock to support the piles, the derrick towers for Piers Nos. 8, 9 and 10 were placed on the upstream side. One derrick tower between Nos. 8 and 9 and one between Nos. 9 and 10 handled these piers.

The cofferdams for Piers Nos. 1, 2, 3, 4, 5 and 11 were 22 ft. by 52 ft. and were made 12 in. x 12 in. inside and outside rangers, and 6-in. specially cut T & G all merchantable fir with 10 in. x 10 in. and 12 in. x 12 in. cross braces. In general the pier sites were cleared by dredging out old logs, brush and in some cases a large number of old piles were pulled out. The river bottom was also levelled as much as possible. By means of this preparatory work the full sets of inside



Sealing open crib. Note mixer plant.

Completed piers on east side.

and outside rangers were weighted down to the river bottom in good shape before starting to drive sheeting. Corner irons were put on several sets of the inside rangers in each corner and after the skeleton was located and made fast, guide or anchor piles were driven in the corners. This gave perfect alignment and a sure anchorage. A drop hammer in swinging leads from the end of the boom was used to drive the sheeting.

The cofferdam for Pier No. 11 was made of 6-in. tongue and groove sheeting and 10 in. x 10 in. rangers, the sheeting driven to rock, cofferdam pumped, the rock cleaned and concrete poured. Some difficulty was encountered in getting down to the rock on the North end of Pier No. 11 on account of the head of water. This amounted to 28 ft. at the lowest point and gave little chance to brace the end of the cofferdam against the smooth sloping rock. The west abutment was put in when the water was extremely low, and all work was done in the dry, the rock cropping out high above extreme low water.

Excavation

The excavation in the cofferdam and the open cribs was made with a clamshell dredge. Excavation was made to a point 18 ins. to 2 ft. below the required cutoff of the piles to allow for swelling during the driving of piles. Very little jetting was required to clean up the bottoms to grade.

Piling

Fir piles (45 ft.) were used in Piers Nos. 1 to 6 inclusive, all having 32 ft. to 36 ft. penetration. In Pier No. 7 longer piles were driven in the upstream end to get the piles to rock or at least to hardpan to care for any uneven settlement that might occur on account of piles in downstream end having bearing on rock.

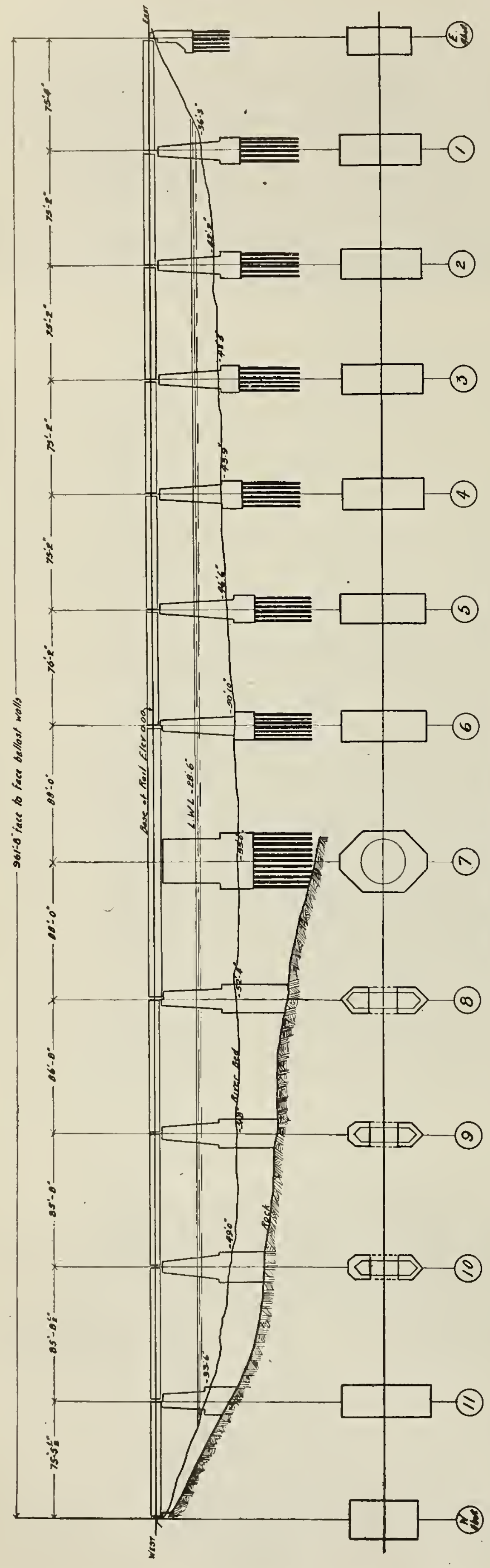
In driving the round piles in the cofferdam, a drop hammer was used in the east abutment where the driving was done in the open, and with steam hammers and Australian Gum followers for driving through the water in Piers Nos. 1 to 4. Using hardwood followers was found to be a serious problem as it was very difficult to get timber that would stand up under the hard pounding necessary to get the required penetration. The types of hammers used were No. 3 Vulcan, No. 1 Georgian Bay and No. 3 Monarch.

In the cofferdam for Pier No. 5, and in open cribs Nos. 6 and 7, the pile driving was done under water.

Open Cribs

Open cribs were used for Piers Nos. 6 and 7. The location of Pier No. 6 was in the East Channel of the old swing-span. Pier No. 7, the new Pivot Pier, was in the West Channel of the old swing-span. The design of these cribs called for solid timber crib for 12 and 17 courses, respectively, above the cutting edge and from that point 3-in. sheeting with rangers spaced as required. The solid part of the crib was framed and built up in the timber yard adjoining the site of the bridge. After launching, they were floated into position, built up and sunk at the same time. Before putting the cribs into position, however, the site had been dredged 18 in. to 2 ft. below the required grade of the seal. This was approximately 10 ft. below the old river bottom. A feature used in the sinking of the cribs was the use of concrete deposited in beams, the forms for which had been constructed as the crib was being built. These beams answered the purpose for weight very well and were a great deal cheaper than

C. P. R. Harrison River Bridge. View of cofferdam between caissons.



General elevation and plan, Harrison River Bridge.

the handling of a corresponding amount of rails or the erection of sand boxes for weighting.

Sealing and Pumping Cofferdams and Cribs

A concrete seal was placed in all cofferdams and open cribs excepting the East Abutment and Pier No. 11. The thickness of the seal depended on the head of water to be pumped and varied from 6 ft. in Pier No. 1 to 10 ft. in the crib for Pier No. 7. The concrete for the seal was mixed in 1:2:4 proportions and deposited through a tremie pipe with excellent results. The tremie was handled by a 5-ton triplex chain hoist and travelled across the cofferdam on an I-beam and trolley supported at either end by 10 in. x 10 in. posts. The latter was moved from end to end of the cofferdam on the top set of rangers. The seal was made in two layers.

The concrete in the seal was allowed to set three to seven days before starting to pump. There were no leaks whatever through the seal in any of the cofferdams and the pumping proved to be a simple proposition. Plenty of pumps were installed each time to pump out the water in the cofferdam rapidly, so that the leaks in the sides could be located and stopped. Generally after the first 24 hours a small Nye Pump kept the cofferdams dry.

Pneumatic Caisson Piers

Owing to the difference in the elevation of the rock in the length of the piers, and to the fact that there was very little material overlying the rock at the downstream end of these piers, open cofferdams could not be used satisfactorily. For the same reasons a pneumatic caisson the full size of the pier would have been difficult and was not required for the load coming on the pier. The scheme used was to sink a small caisson at each end of the pier and connect these with a heavily reinforced concrete slab 6 ft. thick and on this build the shaft of the pier. The caissons being small, approximately 16 ft. square, they were built of 12-in. x 12-in. dressed timber for the working chamber and the deck, 3-in. ceiling and 3-in. friction planks. Above the deck 10-in. x 10-in. rangers and posts with 3-in. planks made the cofferdam.

The usual pneumatic method used by The Foundation Company, Limited, was used here. Amply large compressor and lighting plants were installed on the east bank near the boiler plant. One Standard Company combination man-and-bucket lock was used for all six caissons. A hospital lock was set up in the "Sandhog" house to provide for any cases of caisson disease.

Beyond the sharp dip of the rock in all the caissons, no difficulties were encountered.

There was a maximum head of water 53 ft. in the deepest caisson, which was the north caisson of Pier No. 8, and a minimum of 23 ft. of water on the south caisson of No. 9. There was likewise a maximum of 28 ft. of material from the river bottom to bed-rock in Caisson North No. 8 and a minimum of only 3 ft. overlying the rock in the South caisson of Pier No. 9. These two conditions called for a maximum of 27½ lbs. of air on North 8 and a minimum of 7 lbs. on South No. 9.

The air work was carried on very speedily considering the amount of work and the small size of crew that could be worked to advantage in the caissons. Air was on six weeks and an average of one caisson a week was made in sinking, which included time for changing the lock, changing the derricks, sealing and building up the caisson. One bucket lock was used for the entire job. The conditions of the bottoms required in each case some levelling off or benching of the rock.

Slab and Cofferdams for Piers Nos. 8, 9, and 10.

The method of constructing the slab between the two small pedestal piers, on which the shafts for Piers Nos. 8, 9 and 10 were to be built, was handled rather simply. A floor was made in shape and size to conform to the measurements of the area between the caissons at the point where the slab was to start. Two side panels were made to fit along and lapped by the cofferdams of the two caissons which had been left on with the scheme in view. Two I-beams were then placed on posts in caisson which had been carried up from the bottom, and the sides and bottom of the connecting cofferdams were then forced down to the required grade. Posts were put on cross ties in the floor and under the I-beams to hold the connecting cofferdam down, and it was also bolted to the sides of the caisson above the water. Eight sets of tie rods were put in, connecting the bottom or floor of the connecting cofferdam to the I-beam above. The rods carried the weight of the concrete slab put in after the cofferdam was pumped and the posts held the bottom down while the cofferdam was being pumped and until the concrete slab was in place. After the slab had set six or eight days, the I-beams were taken to the next pier. This gave the concrete time to develop strength enough to be self-supporting.

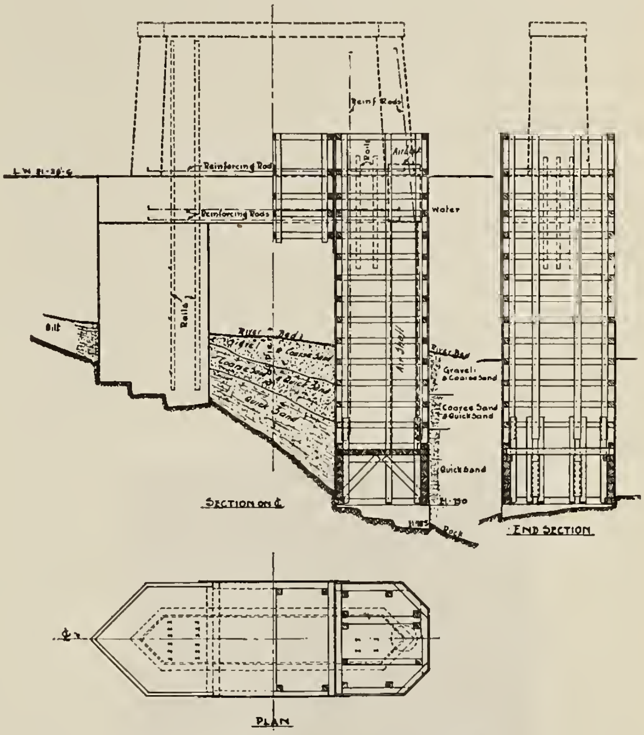
Mixer Plant

A floating concrete plant was used for all the concrete placed. The scow used was 22 ft. x 70 ft. x 5 ft. deep, with a 57-ft. tower; a one-yard Ransome Concrete mixer, steam driven; steam was supplied by a 48-in. x 96-in. upright boiler, a one-yard Insley concrete hoist, hopper, and 10 in. diameter chute suspended from the tower for spouting the concrete into the piers. A cement house on the back of the scow, 18 ft. x 20 ft., stored a day's supply of cement, which was filled either directly on to the scow from the cement house or transferred to it by another scow. One 1¼-in. Blakeslee jet furnished the water for the mixing plant, although a small feed pump was installed for emergency purposes. The engine used for the elevator was a 5 x 7 "O & S" Reversible Hoist and did exceedingly good work.

Air-lock on south caisson pier, No. 10.

The cement was received by cars and unloaded from a spur into a cement house which was raised to the elevation of the car floor. The cement was handled entirely by trucks from the car to the cement house and from the cement house to the scows.

The gravel used was run-of-bank gravel; dredged from Harrison River three and one-half miles above the work, and was as a whole in good proportions and made excellent concrete without any addition of sand, screening or washing. The gravel was received on scows and handled to the mixer hopper by means of a 16-in. belt conveyor. The conveyor was so attached ed that the outer end could be raised or lowered according to the height of the gravel scows. A niggerhead or spool was put on the outer end of the driveshaft and was used to handle the cement from the cement house on the scow to the mixer hopper. The cement was pulled up an inclined track in a small car in the amount needed for each batch. The sacks were untied in the house before being sent up and the empty sacks were sent down each time.



Typical caisson, Harrison River Bridge.

The gravel plant consisted of the following: 1 small stern-wheel river tug-boat; 1 small gravity swing derrick with 40 ft. boom, 20 ft. "A" Frame on 20 ft. x 60 ft. scow; 3 gravel cargo scows (two 22 ft. x 65 ft., one 24 ft. x 60.). A small crew handled the gravel problem, there being only the captain, one engineer, one deck hand, a foreman and one fireman on the dredge, making five all told.

The work was started in August, 1913, and completed on March 31st, 1914. The greater part of the time traffic was very heavy on account of the double-tracking on both sides of the bridge—earth and rock ballast trains besides the regular traffic.

The work was done by The Foundation Company, Limited, for whom W. F. Collar was the Superintendent of Construction. H. Rindal was Division Engineer for the C. P. R., and E. B. Bail Resident Engineer.

Recent Developments in the Field of Municipal Engineering

By F. W. W. Doane, City Engineer of Halifax, N. S.

NO student of municipal engineering would hesitate to say that there are new municipal engineering matters coming along every year. The province of the municipal engineer is a wide one, and its limits are being extended every season.

Municipal engineering has been, in the past, confined principally to works of construction, but in recent years municipal development has created such a change in municipal engineering departments, that the engineer of to-day engaged in such work must not only be an engineer, but a lawyer and financier. Further, we have entered upon an age of administration with a new and larger conception of the possibilities of industrial leadership. The municipality is beginning to refuse to trust for its administration to processes of learning through experience. There is being created a central strategic position, to be occupied by the professional administrator who must be a master of the forthcoming science of administration. For such a position the municipal engineer is peculiarly fitted, both by education and experience.

Mr. F. W. W. Doane.

Let us hope that municipal engineering work will, in the future, be completely divorced from political influence, as it should have been long, long ago. While the office of City Manager is a new one, the idea and the principle involved, will go far as the system becomes better understood. While the man occupying the position of City Manager may not be a qualified municipal engineer, he will, nevertheless, be engaged in municipal work. The problem of discovering the right man for the place promises to be anything but easy. It has been said that a city engineer should have the wisdom of Solomon, the patience of Job, the executive ability of Napoleon, the diplomacy of Tallyrand, and the temper of an angel. That is an order of considerable dimensions, yet it is equalled by the requirements specified in a recent publication for the ideal city manager. He must be a man of most wonderful make-up, naturally humane, patient, tactful, polite, forceful, inspiring, fair, receptive, well educated, quick of perception and decision, and last—but not least—thoroughly trained in engineering and versed in law and finance. Surely it would be a mistake to discuss the salary that would attract such a man. I would suggest that any one finding such a man lying around loose should grapple him with hoops of steel.

I propose to review briefly some of the new matters in municipal engineering.

In roadways, new forms of construction are being tried out every year. A strong and persistent effort is being made to discover a cheap form of pavement or roadway construction which will enable the municipality of moderate means to maintain its roads in fair condition under the destructive traffic of motor vehicles. Many forms of construction have been tried out, but there is none that can be pronounced entirely satisfactory in our climate. Tar or asphaltic macadam has proved to be a better roadway than the old water-bound macadam, but its life is short. The older forms of pavement are too expensive. Rocmac has its admirers but also its opponents. Cement concrete has made great progress in the sympathy of municipal men, and if the tendency to crack can be overcome there is little doubt that it will be a very popular pavement, owing to the low cost in comparison with its permanency.

In this connection, reference should be made to the necessity for a heavier foundation under nearly all forms of pavement. This is being recognized by the most progressive municipal engineers. For instance, the usual construction of sheet asphalt pavement has included a six-inch concrete base. At times, the thickness was reduced to four inches on residence streets. Such thickness will not be found sufficient to carry the travel which is promised in the future, either in such streets or on some of our country highways. With the advent of the motor truck, the traction engine and the motor omnibus, municipal engineers are arriving at the conclusion that even nine inches of concrete will be necessary in some formations to furnish a satisfactory support. Such a thickness will be demanded eventually, because, within a radius of thirty miles of large cities where motor trucking is becoming common, loads amount frequently to ten tons. In the old country, concrete foundations are broken up not so much by ordinary motor vehicles as by those over 3½ tons in weight, shod with steel tires. One class of these is allowed to travel at eight miles and another at five miles an hour. In some places in England, the depth of the concrete foundation has been increased to ten inches.

While experience in this connection has been brief, there is a strong consensus of opinion among English municipal engineers that both foundation and wearing surface should be absolutely stable in character, and with both the concrete foundation and the wearing surface so constructed that they will not move under traffic. The selection of a pavement for hills is as difficult as ever, and can be settled only by an expert.

In water supply, the municipal engineer to-day is studying the problem of greater purification. A discussion of such work is beyond the scope of this article.

In sewerage, the method of disposal is the great problem, and especially the treatment of sludge. Progress is being made every year, and while some theories which promised well have fallen through, others have risen to take their place. There seems to be little doubt that the next ten years will do much to simplify the sewage disposal problem—especially in connection with the sludge.

In street cleaning, improved methods are being recommended. In a recent report on a proposed model street cleaning district in the borough of Manhattan, New York, J. T. Fetherston, Commissioner of Street Cleaning, points out the possibility of introducing many improvements and economies. The system now in use in New York is practically the same as that installed by the late Col. Geo. E. Waring over seventeen years ago. The main feature of the new plan, which is novel only in its adaptation to municipal conditions, replaces horse-drawn vehicles with power-driven motor vehicles, each fitted with three types of trailers—one for street flushing or sweeping, one for refuse collection, and the third for ploughing, sweeping and hauling snow. The remainder of the equipment will consist of a standard type of covered receptacle for holding garbage or ashes, and a transfer station or dump provided with power-operated devices for handling refuse. No other city has taken up the tractor-trailer system, but it is employed successfully by private companies.

While few municipalities may be in a position to spend the money on street cleaning that the city of New York can spend, representatives of those municipalities who are interested in street cleaning, should visit the city of Montreal, where the first motor-driven pick-up street sweeper to be used in Canada is in operation. Motor-driven street sprinklers are, of course, not new, but a new motor street sprinkler brought out by the Tiffin Wagon Company, of Tiffin, Ohio, is worth looking up. It is claimed for this new vehicle that it distributes the water more evenly on a street, that it covers practically twice the territory for each filling, and that it will cover three times the territory of the horse sprinkler in its working day. It would seem within the province of all municipalities to encourage the use of motor vehicles in every possible way, both in their own service and at large. The time is coming when such use will be more urgent.

Sanitation is demanding that the horse be dispensed with eventually on public thoroughfares. Further, because of the ability of the motor vehicle or its driver to navigate better through crowded traffic, congestion, which is a serious problem on all busy streets, is to an extent relieved.

The urban municipality of to-day is doing more and more of its own work and going more and more deeply into municipal ownership or control of public utilities. Civic asphalt plants are no longer rare; the private ownership of lighting plants and water systems is beginning to be the exception; the municipal ownership of street railways has passed the experimental stage; municipal coal yards are already in operation, and the public ownership of coal mines is more than a possibility of the future. Central heating plants have not been adopted by municipalities to any extent, but it is probable that they will be in the near future. As an illustration of the extent to which such work has gone, the central heating plant of the University of Wisconsin, Madison, Wis., may be cited. About 22,000 tons of coal is the annual consumption. Only 10 per cent. of the total fuel is chargeable to power uses. All power exhaust, together with low pressure live steam, is used for heating. At present 42 buildings are heated from the central plant. The distribution system includes two miles of tunnel and one mile of conduit. The maximum pipe size is 16 inches, and on this a total thickness of 3 inches of 85 per cent. magnesia insulation is used. The heating pressure is 5 to 10 pounds and no difficulty has been experienced in maintaining pressure at the receiving end.

The Minnesota Legislature recently gave the engineering and constructional organization of the City of Minneapolis a noteworthy endorsement by passing an Act which authorizes the City to acquire and maintain a union steam railway passenger terminal. Similar extensive powers are vested in the city for the purpose of a grade crossing elimination, for which the city may make complete plans. Efforts in the past to secure a union station in Minneapolis by private action had failed. In the grade crossing work, the cost must be borne by the railways. Even the damage to abutting property is included. One railway is engaged in such work already, but for future work the city will make plans. The City of Minneapolis also has a project for a number of municipal ice houses.

Halifax to the Fore in Town Planning

In town planning, many cities and towns of Canada are engaged in new municipal engineering work. The city of which the writer is the Engineer, has the honor of obtaining the first town planning legislation passed in Canada. It has been protecting residential property and carrying on other similar improvements since 1896.

A bureau of municipal research is one of the latest moves in municipal work. It is claimed that in the city of Cincinnati, a city of 600,000 inhabitants, a bureau of municipal research in two years saved $100,000 on a 5-year contract, $65,000, $17,000 and $168,000 annually, and the whole cost of a purchasing department, besides the discovery of 125 miles of unrecorded sewers. This question, with municipal publicity, is well worth the attention of every municipality.

A recent announcement is to the effect that the Dominion Government, through its Department of the Interior, is placing under reservation all vacant Dominion land that the Superintendent of Water Powers may recommend to be available for the development of water power. Six whole sections of land in Northern Alberta have recently been reserved until a complete survey of the famous power site at Vermilion, on the Peace River, can be made. Similar reservations have been made in the various provinces of Manitoba, Saskatchewan, Alberta, and in the railway belt of British Columbia. These include land contiguous to Grand Rapids on the Athabasca River, the various power sites on the Elbow and Bow Rivers in the Province of Alberta, Grand Rapids on the Saskatchewan River, and all unoccupied land along the Winnipeg River in the Province of Manitoba. It is stated that other reservations will be made from time to time upon the receipt of sufficient information to enable the Superintendent of Water Powers to make a definite recommendation covering a description of the land that might be required for power purposes.

In Nova Scotia, an important progressive step in municipal engineering during the past year was obtaining from the Provincial legislature a general law which provides that in future no private corporation which has authority to erect poles and wires on public streets, can do so without first obtaining permission from the municipality.

It has been mentioned that the municipal engineer of to-day must be a financier as well as an engineer. It may not be surprising, therefore, to find that in Nova Scotia a municipal engineer has suggested a mutual municipal insurance scheme. It has been criticized adversely by the financial journals, but in the opinion of the speaker it has come to stay. Although the author of the scheme was not aware of it, a somewhat similar scheme has been tried out in the old country, with a decided success. The insurance of municipal property only is a business of a non-hazardous nature. The English municipal mutual insurance body reduces premiums at once on municipal property and every five years thereafter. The association is eleven years old and during its existence it has paid all claims liberally and promptly, and reduced the premiums of its policy holders by $50,000. Notwithstanding this, and the low rates of premium charged, it has accumulated $95,000, all of which is solely the property of the municipal fire policy holders, who have increased in number from thirteen in 1903 to over 450 in 1913. The Association's average of net loss for fire during its ten years' work was only 10.7 per cent. of its net premium income, whereas the loss ratio of the average insurance company was 55 per cent. It is quite obvious, therefore, that when a local authority insures with an ordinary company the public are simply paying for the losses incurred by the company in general and foreign business.

Design and Construction of the Bassano Dam[*]

By H. B. Muckleston[†]

THE Canadian Pacific Railway Company has recently completed, as a part of its great irrigation project, one of the most notable overfall dams now in existence. The dam, which is located on the Bow River, about one hundred miles southeast of Calgary, is noteworthy not only because of its dimensions and the composite character of its construction, but also because of the unusually great depth of water which it is designed to pass over its crest during floods.

The Irrigation Project

Much of the greater part of the irrigated area is on the North or Red Deer River slope of the divide; consequently only a fraction of the water diverted will ever return to the Bow River. The total irrigable area commanded by the system is, in round figures, some 440,000 acres. The canal system, to reclaim this large area, involved moving some 21,000,000 cu. yds. of excavation in all classes; over 100,000 cu. yds. of concrete were built into the structures on the main, branch and secondary canals; and 9,500,000 ft. b.m. of timber were used in flumes, bridges and the structures on the smaller ditches and laterals. The total mileage of canals and ditches is in excess of 3,000. It will be seen, therefore, that the project is exceeded in magnitude by few outside India and by none on this Continent.

The first surveys for this project were made by the writer in 1906. They were confined to securing general information and to making rough estimates of the area which could be irrigated and the cost of the diversion works, based on several assumptions as to crest elevation of the proposed dam. These surveys showed that the project was feasible from an engineering point of view and that it could be built within the limit which had been set as to cost. Further surveys were made in 1909, and the crest elevation finally fixed after several alternative preliminary locations of the larger canals and a closer examination of the areas which they commanded.

Design of the Dam

At the point of diversion the main divide between the rivers is very close to the Bow; only 600 ft. away, in fact. At this point begins a wide valley known as Crawling Valley, which cuts square across the country from the Bow River to the Red Deer. Toward the Red Deer River it falls about 65 ft. in 13,000 ft. in the upper region, while toward the Bow the fall is 90 ft. in 600 ft. The average depth of this valley is about 70 ft., and its width about 600 ft. As the summit of the pass thus found was but 90 ft. above the river it offered a splendid opportunity to divert water for irrigation, provided it proved feasible to construct a dam of some height across the river valley.

Fig. 1 is a general site plan showing the location of the dam. The left bank of the river, which forms the outside of the horseshoe, is a high clay cut bank or cliff, varying from 150 to 200 ft. in height, with practically no beach whatever at the bottom except in very extreme low water. The right bank or inside of the horseshoe is a gravel beach gradually sloping up to a silt bank at high-water mark. The tongue of land inside the horseshoe slopes gradually up from the toe of the shoe to the general bench elevation of the adjoining country. It shows visible evidence that it has been built by the river, as the stream gradually cut is way down and widened the sweep of the curve.

Fig. 2 is a general profile showing the result of the borings put down to determine the character of the foundations. Under the clay at a varying depth is a stratum of unknown thickness composed of a coarse water-bearing sand, not quite free running but weakly cemented. Most of the boreholes were stopped when the sand stratum was reached, but a few were carried deeper in an effort to reach the bottom of the sand, though without any success. It was found that the water in the sand was under a slight pressure, which was measured and found to correspond roughly with the fall in the surface of the river in a distance of about 3,000 ft. This was thought to indicate that the

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[*] This article is a condensed and re-arranged version of an article published in two parts by the Engineering News. We are indebted to our contemporary for the line cuts. The half-tone illustrations are from an article published in the Contract Record of December 17, 1913. The reader may be interested in referring to a complete description of the C. P. R. irrigation projects contributed to our issue of April 24, 1912, by Mr. A. S. Dawson, Chief Engineer, Canadian Pacific Railway, Department of Natural Resources.

[†] Assistant Chief Engineer, Department of Natural Resources, Canadian Pacific Railway, Calgary.

Panoramic view of the Great Bassano Dam.

overlying clay pinched out somewhere upstream, and three boreholes were put down to ascertain if this was so. It was found that at 2,600 ft. upstream from the site the clay was only 2 ft. thick. The theory that the water found access from the river was confirmed by subsequent observations on the pressure head in the sand compared with parallel readings of a gage rod in the river. The similarity of the curve was unmistakable, though there was a lag in phase amounting to 30 hr., for which no satisfactory explanation has yet been offered.

The strata under the tongue of land inside the horseshoe are similar to those under the river except that the gravel layer is very much thicker and is overlaid by a stratum of silt left behind by the river as it gradually cut its way down.

When the dam was first proposed, very little was known of the hydrology of the river, the few discharge records that were available being unsatisfactory in that they gave little or no indication as to the maximum floods which might be expected. The only refuge, therefore, was a careful series of gagings and a search for flood marks. From these gagings and what flood marks could be found it was estimated that a flood of 100,000 sec. ft. was possible, and the dam was designed to pass this quantity with 14 ft. of water on the crest. This corresponds to a runoff of 12.5 cu. ft. per sec. per sq. mile from a drainage area of 8,000 sq. miles.

The range in discharge of the river is very wide, varying as it does from a minimum in winter of about 1,200 sec. ft. to the calculated flood discharge above given. Ordinary spring and summer freshets seldom rise much above 30,000 sec. ft., though considerably larger floods of short duration are not infrequent.

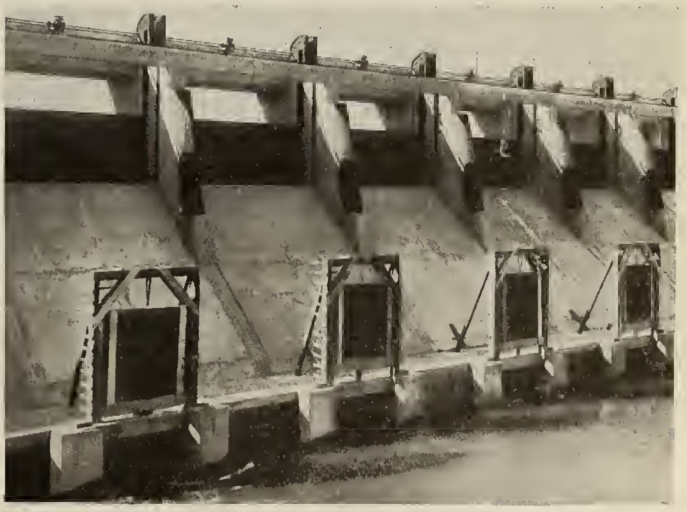
The time factor in flood rises in the Bow is important, variations of 20,000 sec. ft. in discharge in 10 or 12 hours being by no means unusual and often coming without much warning. Owing to the narrow valley and steep slope of the river bed the pondage area above the dam is comparatively small, not over 3,500 acres, during low stages. It was therefore very necessary that means be provided for rapid working of any crest sluices, and also that the earth dam be given an unusual freeboard above ordinary pool level.

The dam as finally built consists of two or rather three parts: (1) an earth embankment 7,000 ft. long, built on the right bank inside the horseshoe; (2) a reinforced concrete spillway section, built in the river bed; and (3) a reinforced concrete canal headwork built at right angles to the spillway and integral with it.

The embankment varies in height from 35 ft. to zero. It was designed to have a top width of 24 ft., with 4 to 1 wet slope and 3 to 1 dry slope, and to have a freeboard at ordinary high stages of 9 ft. The thickness as built is much in excess of what the above dimensions would indicate, as a large surplus of material from the canal cut was wasted over the back of the earth dam, resulting in a top width varying from 40 to 100 ft. The wet slope is protected from erosion by a concrete paving surmounted by a curved parapet wall to prevent any wave wash from going over.

The spillway is 720 ft. between abutments. It is of typical Ambursen section (Fig. 3). The crest is divided into 24 openings, each 27 ft. long, closed when required by Stoney sluices 11 ft. high. The head-

Constructional detail of dam.



Sluice gates.

works consist of 5 openings, each 20 ft. wide, closed by Stoney sluices 14 ft. in height.

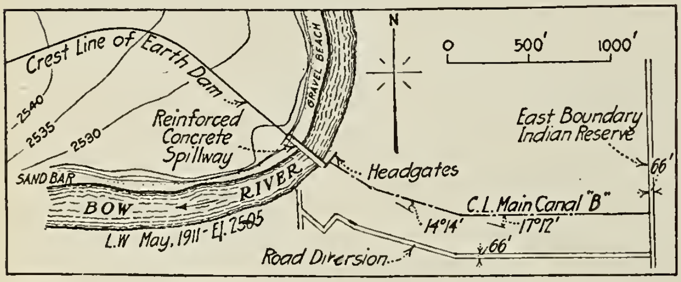
The general design of the composite structure was determined by the Railway Company's engineers after a careful study of all the conditions above outlined. Having decided that the cellular type of reinforced concrete construction would best meet requirements for the spillway and headworks, the detailed design of these parts was placed in the hands of the Ambursen Company, who also undertook the superintendence of construction. All drawings were approved by the Railway Company's engineers before becoming effective. Both design and construction were carried out under very complete specifications approved by both the Railway Company and the Ambursen Company.

The maximum alowable unit stresses used in the design of all parts of the structure were as follows:

Bearing power of foundations	2.5 tons per sq. ft.
Buttresses in compression	300 lb. per sq. in.
Buttresses in direct shear	100 lb. per sq. in.
Footings, compression in bending ...	500 lb. per sq. in.
Footings, tension in bending	0 lb. per sq. in.
Footings, shear in bending	75 lb. per sq. in.
Deck apron, compression in bending ..	600 lb. per sq. in.
Deck apron, tension in bending	0 lb. per sq. in.
Deck apron, shear in bending	60 lb. per sq. in.
Steel reinforcement, tension	14,000 lb. per sq. in.
Structural steel, tension	16,000 lb. per sq. in.

All the above maximum unit stresses are considered as limiting values based on loading of structures due to the greatest expected flood head, namely, 14 ft. above crest and on allowance made for effect of backwater.

For all members of the structure the steel is so designed as to take the entire tensile stress without aid from the concrete. For all buttresses, walls, tumbling hearth, etc., steel is inserted in such quantities as will assure against excessive cracking due to temperature stresses and vibration.



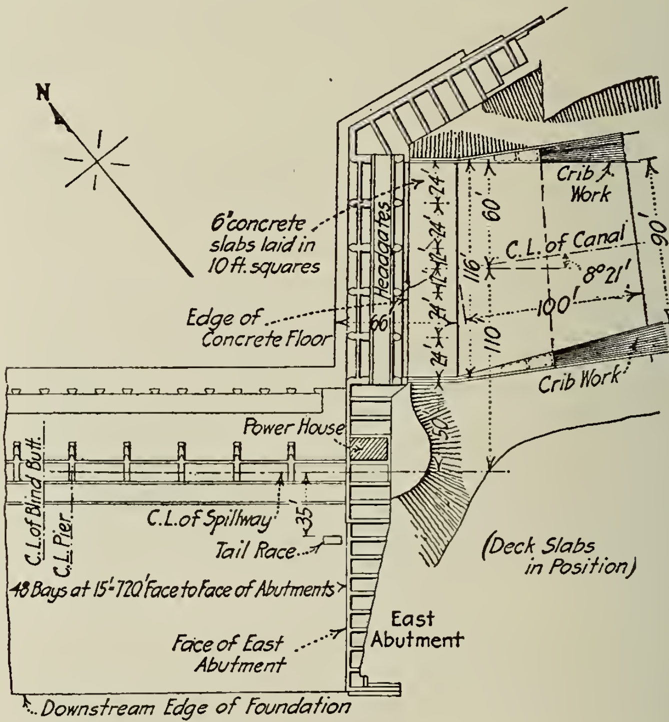


Fig. 1—General plan of Bassano Dam and detail plan of headgates.

All cement was tested on the works and had to conform to the specifications of the Canadian Society of Civil Engineers.

One of the first problems to be solved was the spacing of the interior buttresses. This is a problem which depends on judgment and experience rather than on mathematics for its solution. After a number of preliminary designs had been worked up and studied, it was decided to space these buttresses 15 t.c. to c. and to carry the alternate buttresses up to form piers for the support of the sluice gates.

The floor of the structure is pierced by numerous weep holes to relieve any possible upward pressure from water which might pass the sheet piling and be trapped under the floor.

As mentioned above, the water contained in the sand stratum is under pressure, and strong presumptive evidence existed that this pressure was equivalent to the head of a point about 3,000 ft. upstream. If the presumption were true the upward pressure on the clay might, under certain circumstances, be more than the superincumbent weight, and accordingly steps were taken to relieve it. This was accomplished by twenty-four 5½-in. iron-cased wells bored through the clay and extended above the interior bridge level.

Stoney Gates—For the sluice gates, a great many different types were considered, the choice finally narrowing down to Taintor sectors as against the Stoney free-rolling pattern. The latter were finally decided on, for, while the choice involved a considerable increase in cost, it was felt that they would be better suited to the conditions and more certain in operation. The gates are handled from an overbridge and are counter weighted to 90 per cent. of their unimmersed weight. The overbridge is calculated for a loading equivalent to five tons on two pairs of wheels.

Floating Apron—In order to minimize the effects of any possible scour which may develop below the concrete apron, a floating timber apron has been provided (Fig. 3). This device has been found extremely effective in other situations in preventing scour in soft bottoms or, to put it more correctly, in transferring the scour to a point where it can do no harm. Since the floating apron is not closely built, it is not pressed down flat but assumes some mean position under the combined force of its own tendency to float and the tendency of the current to force it down.

Protection of Sluice Gates Against Frost by Housing and Electric Heating—One of the problems in the design of the dam to which a great deal of study was given was the effect of the peculiar winter climate on the structure and its operation. One of the salient features of the irrigation project is the large interior reservoir lying south of Brooks. It is intended to fill this reservoir during the winter months when the canals are not required for irrigation purposes. This involves very delicate control of the discharge of the

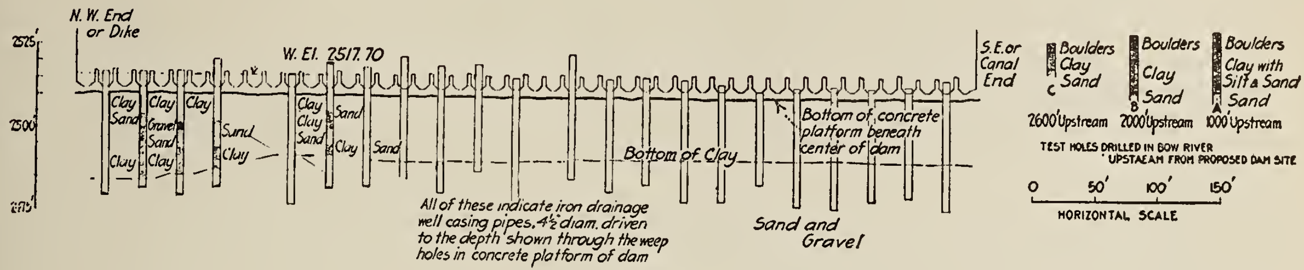


Fig. 2

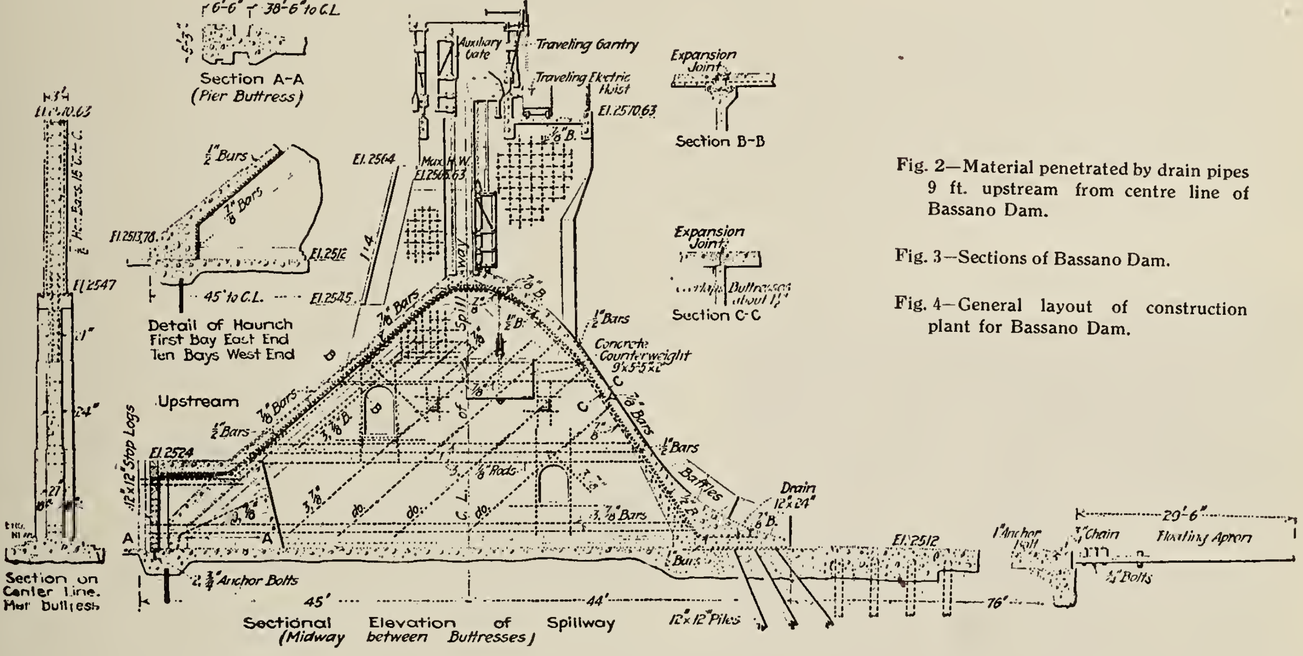


Fig. 2—Material penetrated by drain pipes 9 ft. upstream from centre line of Bassano Dam.

Fig. 3—Sections of Bassano Dam.

Fig. 4—General layout of construction plant for Bassano Dam.

Fig. 3

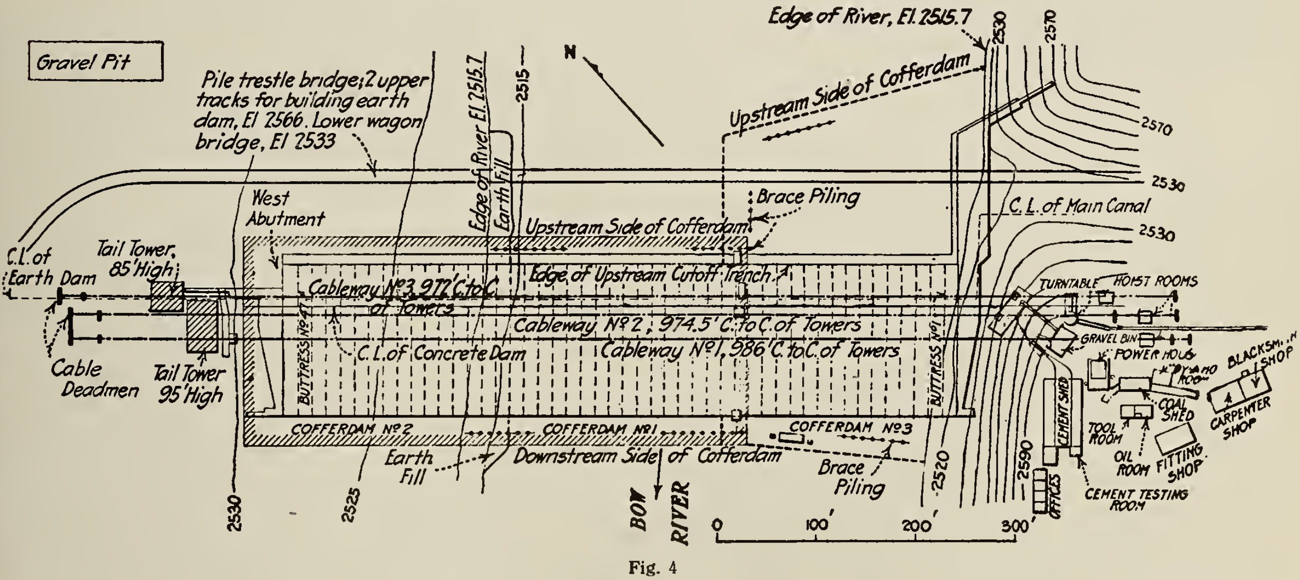


Fig. 4

Design and Construction of the Bassano Dam

canals in order to avoid trouble from ice jams and consequent possible breaching of the canal banks. It will be seen, therefore, that under no circumstances must the crest sluices ever be allowed to become inoperative through frost. To guard against this a very complete system of electric heating for the gates has been installed and special precautions in the way of housing have been taken to insure that all the canal head sluices and two of the crest sluices shall be free from ice at all times.

The effects of ice shove or expansion on the static stability of the dam were very carefully considered and allowed for. It was felt, however, that even so it would be wise to treat the cause rather than the effects, and steps are therefore taken to keep a trench open close above the piers.

Layout of Plant

Construction was commenced in October, 1910, with the erection of the plant and building of Cofferdam No. 1. Fig. 4 shows the general layout of the construction plant. Three cableways with spans of 975 ft. were erected, requiring tail towers 95 to 85 ft. in height on the west shore, and head towers from 47 to 55 ft. high on the east shore. The two upstream cableways, which were used for handling forms and concrete, each had a carrying capacity of three tons, whereas the downstream cableway, used exclusively for gravel, had a capacity of five tons.

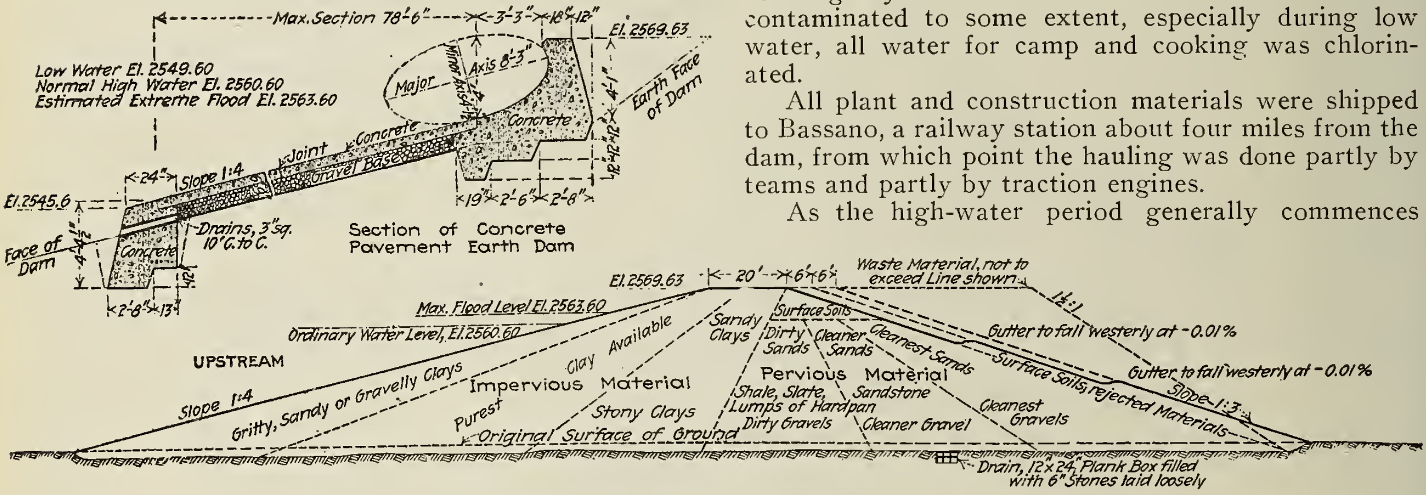


Fig. 5—Earth embankment, Bassano Dam showing disposition of materials and detail of concrete pavement.

Gravel—A gravel pit, located about 500 ft. west of the west abutment and on the upstream side of the earth dam, was opened up, requiring about 16 ft. of stripping. The gravel was found to be naturally well graded, very clean, and containing about 10 per cent. excess of sand. The stripping and excavation was done during the night, and in the daytime the gravel was excavated and conveyed in dump wagons to a trap located under the gravel cable. From here, it was shot into a 2-yd. bucket, which was picked up by the cableway and carried to the 200-yd. gravel bin on the east shore. Two 18-in. steel pipes with sliding controlling gates conveyed the gravel from the bin to two measuring hoppers located above the two 1-yd. Smith mixers.

Cement and Concrete Handling—The cement, which was stored in a cement shed with a capacity of 800 bbls., was by means of an overhead conveyor carried to a hopper whence it was shot down through a 12-in. pipe into a bin placed between the two mixers. The bin was equipped with two spouts in which were fixed measuring slides for the different mixtures, and the cement was in this way distributed to the measuring hoppers which contained the gravel. The whole of the dry mixture was then by a tripping device dumped into the mixers. The two upstream cableways, located directly above the mixers, picked up the concrete buckets, which were of the controllable bottom-dump type, and carried them to wherever concreting was under way. Here the concrete was transferred to a controllable bottom-dump car, which travelled on sectional track resting on the forms. The maximum output of this concreting plant was 350 cu. yds. per 10-hour day.

Owing to the considerable size of the construction plant, well appointed repair shops were installed so that delays might be avoided and repairs and general maintenance carried out in an efficient manner.

The size of crew engaged varied considerably from time to time, the maximum number being about 250. The unskilled labor was principally Italian, the skilled labor being of all nationalities. Suitable bunk houses and dining rooms for each class, electrically lighted and steam heated, were built, and a waterworks and sewerage system installed. As the river water was contaminated to some extent, especially during low water, all water for camp and cooking was chlorinated.

All plant and construction materials were shipped to Bassano, a railway station about four miles from the dam, from which point the hauling was done partly by teams and partly by traction engines.

As the high-water period generally commences about the middle of May and lasts well into August, it was necessary to have each section so far advanced in construction before that time that work could be continued even if the coffer-dams were flooded. The general construction programme was therefore arranged accordingly.

Coffer-Dams—The first coffer-dam constructed took in the central third of the structure, and the river was passed through the easterly third. Upon completion of the central third to a level above high water, the coffer-dam was removed and the river passed through between the buttresses. The westerly third was then started, upon completion of which the easterly third was commenced, with the river passing through the central and westerly section, the design of the type of structure lending itself admirably to such a procedure. The coffer-dams consisted of two rows of piles 12 ft. apart, the piles in each row being 8 ft. c. to c. The outside row carried wailings supporting 3-in. tongued-and-grooved sheet piling, which was driven with a steam hammer, the back row acting as brace piling. As the river is fairly shallow at the dam site, the greatest depth at low water being only 8 ft., no particular trouble was experienced in the construction of the coffer-dams.

Forms—All forms used were sectional. One departure however, was that of removing one entire group of forms together by means of the cableways and reerecting them without taking them apart.

Excavation—Most of the excavating was done by teams, wagons and slip scrapers. As the work was continued all the year round, special arrangements had to be made for thawing out the ground. At the end of the day tarpaulins 100 x 150 ft. were supported by means of horses over the excavation and numerous salamanders placed underneath and kept stoked overnight. In the morning the canvas and the salamanders were removed and work continued. In this way it was possible to gradually thaw the frost out of the ground, although in places it was frozen 6 ft. deep.

Progress—Concrete was first poured in Floor Bay No. 17 on March 22, 1911, and continued without interruption practically until November, 1912, when the bulk of the concrete had been placed.

During the time no stops were made except when the thermometer fell below —15 deg. F., when concreting was suspended until the weather got milder. Special provisions were made when the plant was erected for heating the water and gravel, and as all the forms were double boarded no difficulty was experienced in keeping the concrete from freezing. In fact, it was noted on many occasions that the concrete would still be steaming hot when the forms were removed about four days after the concrete was placed. Construction was resumed in April, 1913, and completed in May, 1914, during which period the canal walls and the housings over the headgates and power house were completed. In November, 1913, the temporary closure of the dam was made with 12 x 12-in. stop logs, followed immediately with the permanent concrete closures, the driving of the piling under the lower part of the ogee curve and the concreting of same.

The piles, which were 12 x 12-in. square timbers shod with cast iron points, were driven to an average depth of 25 ft., with two 1½-ton steam hammers, in inclined leads. This work was done inside a cofferdam built on the concrete carpet and the river taken care of by means of the two 6-ft. under sluices in the middle of the structure. The gravel fill inside the dam was pulled by trains running on the bridge deck and loaded by a steam shovel located at a gravel pit at the west end of the earth dam. The gravel was dumped into hoppers and conveyed to the interior of the dam by means of spouts passing through holes cut in the crest.

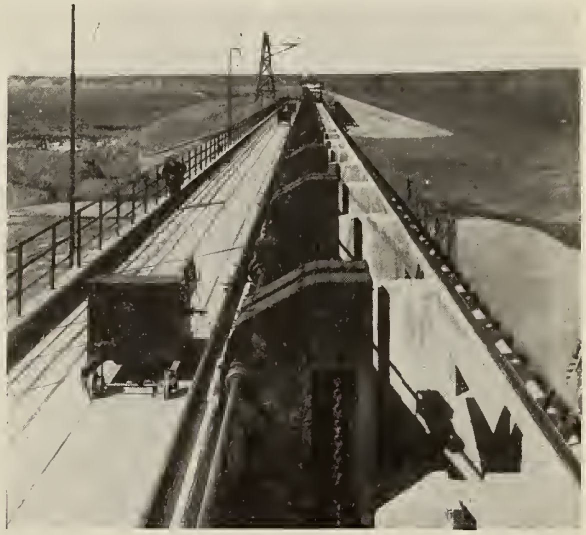
Sluices—The Stoney sluices and all their machinery for both the dam and the headworks were manufactured by Ransomes & Rapier, Limited, of London, England. They are of the usual type, working on free rollers and stanched by a rubber-covered round rod hung in the angle between the pier and the skin of the gate. Each sluice is provided with means for hoisting by hand. Power operation for the crest sluices is provided for by four movable trolleys on the bridge, arranged to engage any one of the operating shafts. In the case of the canal head sluices a separate motor is provided for each gate. In order to prevent any possible damage from over-winding, each gate is equipped with a limit switch which breaks all electrical connections when the gates approach within 3 ins. of the full travel at either end.

The design for the gates and operating mechanism was worked up by the manufacturers under specifications drawn up by the engineers of the Railway Company. The gate, guides and machinery were shipped in the knockdown, and erected by the Railway Company under the supervision of an expert erector sent out from England. So well had the work of manufacture been done that the various parts went together with little or no subsequent alterations or fitting.

Auxiliary Gate—As an emergency closure in case of accident to the main crest sluices, a special auxiliary gate is provided. This gate is similar to the permanent gates except that the position in the guides is reversed so that the skin is on the downstream face of the girders instead of the upstream face, and that an endless chain of live rollers working on the gate is provided instead of the rigid roller trains provided for the main sluices.

The auxiliary gate is handled by a gantry crane running on rails on the bridge girders. As the gate will be used but seldom, no provision is made for counterweights or power operation.

Power Plant—As stated above, the time factor in flood rises is so small that special provision was necessary to insure very rapid operation of the crest and canal sluices. To provide electric power for this work, a small power plant was built in a chamber provided for the purpose in the east abutment. The plant consists of a 180 h.p. reaction turbine, with Woodward governor, connected by belt to a 100 kv.a., three-phase, 60-cycle, 2,400 volt generator. The plant is equipped with step-down transformers furnishing current at 110-220 volts for the operation of the motors and for a complete lighting system in the dam and about the headworks.


Looking across the Bassano Dam.

Earth Embankment—The earth embankment (Fig. 5) was built of selected material from the canal cut. The specifications provided for the most approved methods of construction by spreading and rolling the materials in thin layers and for sprinkling if found necessary. The rear half of the dam is underdrained in order to steepen the plane of saturation, and to intercept any possible flow along the surface between the dam proper and its foundations. Before commencing construction, the foundation surface was carefully stripped of surface soil and thoroughly plowed to give a good bond.

The contractor for the earth portion commenced work by building a double-track narrow-gage trestle across the river. On the right bank, this trestle was continued as two single-track trestles about 100 ft. apart. The material was loaded into dump cars and hauled by locomotive to the dam, where it was dumped from the trestles and spread by four-horse Fresno scrapers. The continual trampling by four horses abreast, and the thin spreading which this method resulted in, gave such a thoroughly dense bank that the clause of the specifications relating to rolling was not exacted.

At the connections with the spillway the earth was very carefully spread and compacted. A good proportion of this work was done by sluicing in material by means of a jet of water under pressure. The material available was not very well suited to the process, being an unusually pure blue clay, and the result has not been entirely satisfactory owing to the very long time required for the backfill to drain.

Personnel—The preliminary designs for this dam and the surveys for the project of which it is such an important part were made by the writer. The detailed designs for the spillway and headgates were made by the Ambursen Hydraulic Construction Company.

H. Sidenius was resident engineer for construction of the concrete work, and has assisted in the preparation of this article. A. J. Raymond was Superintendent of Construction. A. Frohoefer, Division Engineer, was in charge of construction of the earth embankment and paving, and the excavation of the canal.

The work as a whole was under the direction of A. S. Dawson, Chief Engineer of the Department of Natural Resources, Canadian Pacific Railway Company, Calgary, Alberta.

Reinforced concrete roof tiles have been placed on a number of buildings constructed in connection with the Catskill Aqueduct, according to the 1913 report of the Board of Water Supply of New York City. The tiles were made of 1:2 mortar reinforced with 1½ x 3-in. wire mesh. All tiles except the hip tiles were made with the weather surface up, shaped and surfaced with a special steel screen. The hip tiles were cast in sand molds. Under test the flat tiles showed an ultimate strength of 30 lbs. per inch of width when centrally loaded on a 35-in. span, and were impervious under a 3-in. head of water when twenty-eight days old. In place, they also stood well under rains and snows, showing no leakage at any time. From the satisfactory results of this experiment it was determined to use concrete tiles to roof all aqueduct superstructures.

The city of Alexandria, in Egypt, is setting an example in proceeding with municipal enterprise in the face of the depression brought about by the European conflict. The municipality is asking for tenders until December 8th for the installation of a drainage system comprising the construction of a general system of sewers, the erection of a pumping station and the building of a main outfall into the sea. We note that plans may be obtained upon the deposit of 40 piasters ($2.00).

Water-bound macadam is being used in the Panama-Pacific Exposition for most of the streets and driveways, the total wearing surface of which is about 444,000 sq. yds.

Interesting Process of Manufacturing Steel Pipe

EXTENSIVE additions are being made to the waterworks system at Bombay, India. The work is interesting as it marks the first occasion upon which huge steel pipes of the lock-bar type have been made in that country. The contracts awarded to date total two and one-quarter millions. The total length of the new main will be about thirty-three miles. Half the length of the main will consist of steel pipes which are being manufactured on the scene of the work.

The manufacture of the steel pipes is carried out in the city of Bombay through an interesting process. The pipes are made in 28-foot lengths or over twice as long as the pipes of which the present main is constructed, and are 50 inches internal diameter.

To follow one of the large steel sheets, which measure 28 feet long and 6 feet 7 inches wide, through the works will illustrate the process of manufacture. The sheet is first lifted from the stack by a hydraulic crane and then passed through a set of rollers to take out any bends or buckles which it may have received in transit. After having been straightened it is passed on to a very large and powerful planing and upsetting machine. The next stage is to bend this 28-foot long sheet to a half circle, and for this purpose a set of rollers specially designed to take this long length of plate are used. The next operation is to join two of these long half circular trough-like sheets together to form a pipe, and this is where the lock-bar joint is used.

The next operation is to close down the lock bars over the thickened edge of the plate, and this is done with a powerful hydraulic press. This press is arranged to close both bars at once, and this result is obtained by having a mandril which supports the pipe inside while a ram comes up from the bottom and squeezes the bars home in the tools or dies shaped specially for this purpose, the top die being supported by the casting of the press. The force exerted by this press is 450 tons at each stroke. The dies are about a foot long, and a few inches only are done at a time, the pipe being moved through the machine till it is completed. The next operation consists of trimming the ends of the pipes, the bars and the sheets not being supplied exactly to length nor exactly square. This is accomplished with a couple of hydraulic shearing machines. The pipe is then ready to be tested before receiving its protective coating. Each pipe is filled with water and tested to 200 pounds per square inch It is then rolled to and dipped into a steel tank, which is full of a mixture of tar and Trinidad asphaltum, which is kept at a temperature of 350 deg. F. by furnaces which are arranged under it. The pipe is allowed to remain in this bath until it reaches the same temperature as the bath itself, and it is then hauled out and lowered into a revolving frame. While in this frame a strip of hessian cloth is laid on the pipe while it is revolving, the result being that the hessian is wound up on the pipe spirally from end to end.

The next operation is to spread more of the mixture from the tar bath on top of this hessian, thus thoroughly saturating it. A coating of sand is then thrown on the pipe, and while the pipe is cooling any roughness in the coating is smoothed down by the use of hand rollers. When cooled sufficiently for the coating to harden the pipe is rolled away ready to be taken away to be laid and jointed.

Refuse Destruction—The Evolution of Efficient and Economical Methods of Disposal

Contributed by R. O. Wynne-Roberts, Regina.

ONE of the primary duties of a municipal authority is to dispose of the waste products of a city, quickly, hygienically and economically. Sometimes, however, such a duty is a somewhat difficult one to carry out. The satisfactory disposal of sewage, for example, has engaged the attention of specialists for many years, and it must be acknowledged that in a great number of places the efforts to treat sewage efficiently have been more or less failures, for a satisfactory effluent is to be found in only a few places. Yet a solution must and will be found for this problem, and meanwhile communities have perforce to adopt the best available process.

In the matter of refuse disposal the situation is somewhat dissimilar, for a large number of towns have surmounted the difficulties with good results.

The temptation is to dispose of the refuse by the easiest way, even if it is not the most sanitary means. Refuse tips are plentiful, but the modern tendency is to abolish such dumping grounds as are used without discrimination, and adopt some other method. It is somewhat late in the day of advanced sanitation for filth to be deposited on the outskirts of a city without care or consideration and thereby be an annoyance to the people who are dwelling in the neighborhood, if not create a menace to the public health.

Town refuse consists of such a heterogeneous mixture that it varies in every load, every day, and in every place. In cooler climes there is a large proportion of ashes, whilst in warmer latitudes vegetables and other refuse will be more pronounced. Refuse from towns in districts of high rainfall and humidity will probably be more moist and resistant to fire than in districts of low rainfall and humidity, in spite of the receptacles being usually covered.

The quantity of refuse produced per capita in Europe is less than in America and as a rule no division is made for the purpose of collection.

In America, town refuse is often divided into three main classes—garbage, which "consists of organic waste or residue of animal, fruit or vegetable matter, and any matter or substance used in the preparation, cooking, dealing or storage of meat, fowls, fruit or vegetables"; ashes, which "constitute waste due to the combustion of coal or other combustible material from residences, manufactories or business places and consist of fine ash, clinker and unburned coal"; rubbish, which consists of discarded and useless waste matters from residences or places of business not classified as garbage or ashes, such as paper, straw, excelsior, rags, bottles, old clothes, shoes, tin cans and other like waste materials."[1] There are other refuse such as manure, street sweepings, dead animals, night soil, sludge, etc.

In America the collection of town refuse is often made separately for each class named. Separate receptacles have to be provided and the contractors or the municipal authority make periodical calls to remove each class of refuse. Much depends upon the frequency of such collections, as to the cost of the work and the efficacy of this system. Daily removal by municipal forces will obviate practically all nuisance, and if rightly organized a combined collection can be as economically done, if not more so, than insisting on the wrapping of garbage in paper and the separate collection at less frequent intervals. It can be easily understood that the separation of garbage, ashes and rubbish entails the loyal support of the householders and the ordinary experience is that the simpler the duties imposed upon the householder and others, the more likely they are to be performed.

The common method of refuse disposal is by dumping it into depressions or pits or on waste land. Reference has already been made to this and it is therefore necessary only to state that progressive authorities are becoming more insistent that such a method is not desirable in well governed cities, unless due care is taken to cover the refuse with earth or other deodorant.

Mr. R. O. Wynne-Roberts.

The disposal of garbage on pig farms is repugnant to the minds of all citizens having a high regard for the welfare of the people, and for the production of food by clean methods. It is stated that about 75 pigs are necessary to dispose of one ton of garbage daily.[2]

In Los Angeles, Cal., the garbage piggery was investigated by the Grand Jury. They reported that "the investigation of this Grand Jury shows that at the present time (March, 1912) there are located on the hog-ranch about 21,000 head of hogs; that the percentage of death of the hogs ranges from 40 to 65. We find further that the percentage of tubercular hogs on this ranch ranges from 10 to 20. Of this number two per cent. are condemned by the health officials, the other portion being placed on the market. We further find that cholera, strike, swine plague or swine fever is prevalent at the ranch at all times. In fact we find that at the present time this hog-ranch is quaran-

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NOTE—Small figures placed at the upper right-hand position of a letter appear frequently throughout this article. They are the author's references to sources of information. The details are given collectively on page 1173.

tined for all purposes except for the purpose of slaughtering for food."[2]

It is palpably unnecessary to add to the foregoing indictment. The writer is unaware if this practice prevails in Canada.

It may be stated that a contractor has recently been awarded the contract for the disposal of the garbage of Los Angeles by means of a garbage reduction plant. The city is to receive 51 cents per ton for the garbage.[3]

Two cities in the United States own garbage reduction plants, namely, Columbus and Cleveland, Ohio. There are other cities where contractors have erected reduction plants to deal with the garbage of these cities.

This method was first introduced in Germany (where, curiously, it is not much used today), and later on, it was introduced into the United States. It is similar to the plants installed in packing houses to dispose of the offal and to convert it into saleable by-products. Some of the reduction plants are operated on the "drying method," but the "cooking method" is stated to be the most satisfactory. The process consists of placing the garbage in steel digestor tanks, and when about 10 tons are so disposed of, the valves are closed and steam is admitted. After a few hours' cooking, the mixture is pressed to extract the free grease and the moisture. The solid matter is then dried and afterwards saturated with naphtha, gasoline or other solvents to dissolve the remaining grease. The solvent is recovered by distillation and the grease and tankage are sold to buyers, who refine the grease for various purposes, and the tankage is used for fertilizers.

Columbus is a city of about 185,000 inhabitants and the reduction plant has cost about $220,000. The sale of the grease and tankage brings more revenue than is sufficient to pay the cost of operation, plus the capital charges, as will be seen below.

Financial statement for 1913

1,095,594 lbs. of grease sold	$40,839.35
2,095 tons of tankage sold	14,223.31
Hides	1,247.39
Miscellaneous	489.73
Total receipts	$56,799.78
Total operating expenses	39,560.25
Gross profit	$17,239.53
Allowing 4% interest and 20-year sinking fund	16,292.00
Net profit	$ 947.53

The total quantity of garbage received was 20,710.74 tons, so the net profit amounted to about 4.57 cents per ton.

Garbage, however, is only one portion of town refuse and incidentally it may be mentioned that the householders in this large city have to dispose of their refuse, other than garbage, by arranging with any one of the 140 private contractors.[4]

Columbus is now installing a Sterling destructor to cremate rubbish only. Natural gas is available and consequently the proportion of ashes is stated to be small.

Garbage reduction plants are capable of being operated with profit, in cities of over 100,000 inhabitants. Mr. C. O. Bartlett, however, expresses the opinion that any small place producing one ton of garbage per day can be successfully treated in this manner.[3]

A full description of the reduction plant erected at Boston for the Boston Development and Sanitary Company is to be found in the Engineering Record of May 10th, 1913, and of the Columbus plant in Mr. Irwin S. Osborn's report of January 1st, 1913, to which those interested in this process are referred for further particulars.

A number of towns in Britain have adopted the Lightning Dust Manipulator, for instance, Southwark, a large borough in London, Halifax, Hove and others. The process consists in pulverizing the raw refuse into manure. This is done by means of high speed revolving hammers striking the refuse against the breaking block and a final disintegration effected by trituration between the hammers and the grinding plate. Southwark sells about 20,000 tons of manure annually. The manure is similar to black mold, and as the Southwark works are located in a populous part of London, and the plant has recently been extended the process is practically inoffensive. Hove is a large fashionable seaside resort in South England and Halifax is a large commercial centre in Yorkshire.

The text of this paper is Refuse Destruction and the remainder of the writer's observations will be confined to it.

For the sake of a clearer definition, furnaces operated at a temperature of about 1500 degrees Fahr. or less, will be called incinerators, and those which have a working temperature of over 1500 degrees will be called destructors. In America these furnaces are called low and high temperature incinerators, respectively. It seems preferable to know what is referred to by a distinctive name, rather than by a qualifying term which is often omitted.

Fire is the oldest and best known method of disposing of offensive rubbish. It has been adopted by all races and in all ages, with more or less satisfaction. Burying offensive matter is another ancient and effective way of getting rid of such matter.

The first engineer who successfully designed a furnace to effectually destroy town refuse by fire was Mr. Alfred Fryer, of Nottingham, England. This was in 1874. He built two such furnaces in Manchester in 1876 and these have been extended and improved and are still in use, which fact, at least suggests that Fryer had evolved a scheme based on right principles.

This innovation, however, met with a hostile reception. The public prejudice against the adoption of such furnaces was so strong that it is surprising they survived.

Following Fryer there were several aspirants who claimed to have designed furnaces superior to Fryer's; for example, Pickard's "Gommand," Wilkinson of Birmingham, Healy of Brighouse, Heard of Paddington, Burton of London, Stafford and Pearson and others, but Fryer's furnace held its position. These and some which were designed later on, were of the incinerator class—low temperature, slow burning, producing soft clinker and obnoxious gases. Mr. Charles Jones (Ealing) in 1885 introduced his "fume cremator" which was an ample proof that something was needed to improve the combustion.

Mr. William Horsfall in 1887 brought out the first high temperature furnace, which improvement gave a new impetus to the process. Horsfall also improved the furnace by arranging for a front exhaust of gases, by which means all gases had to pass over the active grate before being discharged and by so doing the fume cremator was found to be unnecessary and was ultimately abandoned.

From 1887 to the present time many improvements have been introduced, such as steam jet blowers, forced air draft, regenerators or air preheaters, continuous grates, mechanical feeders and clinkering, dust catchers, steam producers, and so on. As each maker has devised certain features in connection with furnaces, etc., they will be referred to collectively as far as possible.

Incinerators, then, are the survivors of the earliest types and destructors are the later developments.

Incinerators are furnaces capable only of slow combustion and require some form of drying-hearth or device for reducing the moisture contained in the refuse, preparatory to cremation. Some incinerators are charged with large quantities of refuse at one operation, the result being the lowering of the temperature of the furnace, the prolonging of the period of cremation as the combustion is more often local than general, the passage of green gases and the production of soft clinker and little steam. An analysis of the gases and a record of the maximum and minimum temperatures in incinerators will doubtless show that the work done is not altogether satisfactory.

Experience has shown that with destructors, the same as with other furnaces, the percentage of carbon dioxide, oxygen and carbon monoxide contained in the gases in the main flumes, is in proportion to the completeness of the combustion of the fuel and the carefulness of firing and clinkering.

It is manifest that not even the best coal-fired furnace can produce satisfactory percentages of the above constituent gases of combustion unless the temperature of the furnace is uniformly maintained, the range of heat fluctuations kept as small as possible, the quantity of primary and secondary air supplied is controlled to satisfy as nearly as practicable the requirements of the fuel used, and that the fuel is charged in small and regular quantities. Although coal is not usually quite constant in its calorific quality, it is vastly more so than town refuse, and if care is needed in the case of coal-fired furnaces, it is reasonable to advocate somewhat similar care in the cremation of refuse, if scientific and sanitary results are to be achieved.

Many incinerators require coal or other fuel to assist in the combustion of refuse, although the proportion of combustible matter in such refuse approximates that contained in refuse in other places where with destructors no other fuel is required or used, and good clinker and power are produced.

Engineers have during the last century developed the design of coal furnaces for steam raising and countless other purposes. Different grades of coal require different types of grates, etc. It would not be expected that a grate designed to burn steam coal with the maximum of efficiency would produce good results if bark were consumed.

A prudent manufacturer who requires a furnace for any ordinary industrial purpose would ordinarily adopt one that has already proven efficient, and if for any special purpose which needed some experimentation, he would start where others had left off (unless he had good reasons for doing otherwise) and so make use of whatever knowledge that was available.

Bearing in mind what has been achieved in many parts of the world with destructors, it would seem inadvisable to erect incinerators.

The more municipal engineers investigate this important problem, the more readily they will appreciate the necessity for the fullest consideration of the capabilities of various types of furnaces which it is contemplated to install.

There are several makes of destructors and incinerators on the market, and the writer does not propose to exploit any particular one. Each maker claims to have some features of superiority over others and doubtless some do possess certain advantageous qualities.

The original furnaces were top-fed and some are now being built on this plan, but in course of the last ten years or so back feed and front feed arrangements are found to answer rather better. Top feeding allows of mechanical labor-saving devices to be used, but even then it entails more arduous labor to the men below in raking in the material by long rakes over the fires. Back feeding was introduced in 1891 and is claimed to be under better control, whilst front feeding means a better concentration of labor. Conditions will vary in different places and these must be taken into account when deciding the method of feeding.

Destructor furnaces require a strong draft in addition to the normal pull of the chimney, although as one writer stated that since it has been demonstrated that incandescence can be maintained apart from the use of fans and regenerators, the question to be considered is whether it is good practice to run machines which absorb up to 15 per cent. of the total steam produced[5]. The steam jet is a simple, effective and economical blower, and the fan, being entirely mechanical, is more subject to wear and tear and liable to breakdowns and therefore should be in duplicate. The furnace pressure should be in balance, that is, the force of the blast under the furnace should be slightly in excess of the draw of the chimney, so as to render the intake of air at the doors during the time charging or clinkering takes place, as nearly nil as possible. The aim, nevertheless, of the furnacemen is to have these doors opened as few times as possible.

The advantage of either forms of blast does not appear to be very pronounced and to provide for all contingencies the makers now usually include both in recent installations.

Preheating of the primary air is claimed to be of considerable value. The air after being preheated absorbs the moisture in the refuse most readily, and this is found to be done sufficiently quickly that refuse can be cremated without the intervention of drying-hearth. In ordinary steam boiler practice preheated air is found to be of much value, for it increases the amount of water evaporated per hour. Brislee[6] gives an example of the advantage of preheated air. Two boilers were tested with the following results:

	Number 1 Boiler		Number 2 Boiler	
	cold air	hot air	cold air	hot air
Weight of water evaporated in pounds of water per hour	22910	40966	15800	24600

The increased evaporation was due to the extra heat brought into the furnace and the increased rate of combustion of fuel due to it.

In the case of the boiler No. 1 the evaporation was increased 79 per cent. and the No. 2 55.4 per cent.

Brislee points out that if air is heated before combustion is allowed to take place, then the heat in the air is added to the heat of combustion, and the quantity of heat available for raising the temperature of the product is therefore greater. In other words, conditions being equal in other respects, the preheating of air means economy of coal and the increased output of the boiler.

In destructors, regenerators, however, do not constitute the only method of preheating of air. Regenerators consist of stacks of pipes, through which the hot gases pass out on their way to the chimney and around which the cold air passes into the furnaces. The sensible heat of the hot gases is partially imparted to the cold air and in this way the temperature of the air is increased from 200 to 300 degrees or often more. This, of course, means the conservation of heat which would otherwise be lost in the chimney. Such regenerators offer some obstruction to the outgoing gases and to the incoming air, and to overcome this it is necessary to absorb some energy in driving fans. About 5 to 10 per cent. of the total steam produced from the refuse is thus utilized. Regenerators have in some instances been taken out for different reasons. It is easy to arrange for the primary air to be heated by passing it through flues built in the walls of the furnaces. This is being done in gas works practice and has been found to be very effective. Indeed, such method of preheating air or an adaptation of the idea is provided in some destructors. Incidentally, the air required for the furnaces is taken from the vicinity of the refuse and by this means the building is ventilated.

Continuous grates in one chamber are supplanting individual cells and grates and the advantage is evident. In the case of individual or single cells when refuse is charged into the furnace, it has the tendency of lowering the temperature of that cell, and the effectual mixture and burning of the gases must take place in the combustion chamber; whereas in the case of the continuous grates, two or more grates are built side by side in one chamber with independent ash pits beneath. When any refuse is charged into any one of these grates, the cooled gases therefrom are mingled and burnt in the furnace itself and no green gases can escape into the combustion chamber without first passing over an incandescent body. Meldrum's Simplex Destructor was the first constructed on this principle and its usefulness was appreciated by other makers. Heenan and Froude, Horsfall, Fryer, Dawson and Manfield and other destructor builders now design some form of continuous, twin or series grates.

Mechanical stoking and clinkering and other forms of labor-saving devices are installed in a number of destructors. Boulnois and Brodie's charging trucks, Marten's charging apparatus, Horsfall's tub feed, Heenan and Froude's hydraulic feeder and others are examples of the methods most in use. Heenan and Froude's trough grate and hydraulic ram clinkering machine and Sterling's clinkering grate are installed in many plants. According to Mr. Fetherston's report[7] the arduous work of charging and clinkering at the Clifton (New York) destructor has been reduced by the use of the hydraulic ram charger and clinker and trough grate. The following figures are extracted from his report.

COMPARISON OF WORK ELEMENTS. OFFICIAL TESTS.

Plant. Both in New York	Cost per ton supervision and labour.	Pounds burned per furnace-man per hour.	Pounds burned per sq. ft. per hour.	Perc'tge of time furnace door open.
West New Brighton, 1908.	$0.76	1357	54.3	73.7
Clifton, 1913	$0.41	3330	144.2	5.1

Mr. Fetherston, however, expresses his opinion that some time must elapse before the complete economy of the mechanical device is demonstrated.

Conveyors have been tried in several installations, but owing to the heterogeneous character of the refuse, they have not always been found to answer. The same remark applies to refuse elevators, etc. The there buckets and rake elevators in use at the Hackney destructor (London, England) capable of raising 10 to 12 tons an hour, are found to be very expensive to maintain and are liable to serious breakdowns.[8]

Hoppers or storage bins above the destructor furnaces are often found to be unsatisfactory owing to the tendency of the refuse to bind and arch over the opening, and the bulky nature of the refuse often renders the hoppers inadequate in capacity, in which case some city authorities store the refuse in the carts or wagons and thus obviate creating a nuisance. In some cases the refuse in bins tends to ignite and cause an emission of noxious gases. In recently built destructors the hoppers are located behind or in front of the furnaces and are sufficiently large to hold one or more days' supply. Such a position is both cool and handy for hand firing.

In the more recent developments of destructors the authorities have observed that it was possible to derive considerable steam power. The ordinary steam producing capacity of destructors is calculated at one pound of steam for each pound of refuse burned and as one horse power may be based on 30 pounds of steam per hour, it will be seen that one ton (2,000 pounds) will on the above basis produce 67 horse power, but a large quantity of steam is required for the plant itself, so that the net quantity of steam available for other purposes is less.

There are plenty of instances where the production of steam has exceeded one pound per pound of refuse.

Official tests made at the Clifton destructor in 1913 with a winter mixture of refuse gave a gross equivalent evaporation from and at 212 deg. Fahr. of 1.00 to 1.11 pounds at a pressure ranging from 117 to 126 lbs. per sq. inch, but at the New Brighton destructor the results were 1.10 to 1.41 pounds of steam at a pressure of 130 to 137 lbs. per sq. inch. The production of steam during the year 1911 was 1.23 pounds per pound of refuse.[7]

In Milwaukee the evaporation was 1.34 to 1.45 pounds and at Westmount, P.Q., from 1.48 to 2.11 pounds.[4] In Calgary, Alta., the average evaporation at tests was 1.13 pounds. In Darwen (England) the average evaporation during the year was 123 lbs., whilst on a test when burning unscreened refuse and slaughter house refuse was 1.55 pounds of steam from and at 212 deg. Fahr. In Huddersfield (England) with one part of sewage sludge and two parts of refuse 1.4 pounds of steam were obtained.

A test was made in Lochdale, England, for the purpose of comparison. By using ordinary coal slack having a calorifi value of about 12,500 B.T.U. 7.33 pounds of steam were produced from and at 212 deg. Fahr., as compared with 1.97 pounds from refuse.[9] At Montgomery (Alta.) in 1911 the following test results were secured: 1.37 pounds of steam per pound of refuse; carbon di-oxide in the waste gases 11 per cent:; temperature in combustion chamber 1920 deg. Fahr.; the refuse consisted of 25 per cent. ashes, 42 per cent. garbage, 13 per cent. rubbish, and 20 per cent. manure.[2]

The steam produced by burning refuse is utilized for a variety of purposes, such as pumping sewage, or water, generating electricity, etc.

Part of the steam generated from refuse in London, Ont., is used for heating the Victoria Hospital which is situated fifty feet away. In one city 72 million foot pounds of energy is derived from every ton of refuse and used for pumping sewage. In Liverpool and Rotterdam, for example, the electric energy generated is used for street railway operation. In West New Brighton and Clifton plants already referred to, a large quantity of steam is not utilized owing to the fact that the New York City charter prohibits its sale and consequently no revenue can be derived in this manner. This represents a loss of about $7,500 per annum. The quantity of refuse burned at each of these places is about 9,500 tons a year. In Westmount, P.Q., the destructor is an auxiliary enterprise operated in the same building as the municipal electric lighting plant, the steam generated by the cremation of the refuse being used in the production of electrical energy. Messrs. Hallock and Runyon, the engineers who were appointed to report on the disposal of refuse by the city of Newark,[4] stated that the total revenue in 1910 for electric lighting and destructor plants was $102,149.17, and the total cost of operation of the combined plant was $75,426.38, leaving a net profit of $26,722.79. The operating costs include all capital charges and depreciation. The cost to the Health Department for the refuse destroyed was $9,449.06 for the year. The population of Westmount is about 16,000.

One incidental result of good steam production is the production of good clinker, which can be used for many purposes. Low temperature cremation results in soft clinker which is not only useless but objectionable, as it cannot be used and it often contains partially consumed organic matter. Clinker should be well fused and vitrified and this can only be produced by maintaining a uniformly high temperature in the furnace.

Good clinker is used for making pavement slabs, for sewage filtering media, brick making, crushed into sand and mixed with lime for mortar, etc.

Reference has already been made to steam production. In the earlier plants the boilers were placed in the furnace directly over the fire, but it was found that the cooling effects of such boiler militated against the successful cremation of the refuse. The next step was to place the boiler between two cells and although better results were obtained, the makers in later installations have located the boilers beyond the combustion chamber. By this means the maximum temperature is secured and the gases adequately combusted before coming into contact with any cooling surfaces. The figures quoted point to the possibility of developing considerable power by the high temperature cremation of refuse. If due attention is paid to the fundamental requisites of a destructor the cost of operating the same can be materially reduced by the sale or utilization of the steam and hard vitrified clinker produced.

In conclusion, the author has observed that some disappointment has in places been experienced owing to the makers' claims being exaggerated and impossible of realization. It would of course be folly to decry every new device, arrangement or design, until it has been put to a practical test, for that would be tantamount to placing an embargo on all legitimate developments, but experiments are costly and occasionally disturbing as was recently found to be the case in a large plant in North America, whose designers received due publicity in engineering journals. The achievements that were going to be accomplished fell short and the works are now being improved.

The evolution of the destructor has been slow and expensive and the results of experience in all parts of the world has greatly assisted the makers in deciding upon the arrangements, capacity and construction best suited for the refuse produced in different places in different climes.

New York, Westmount or other destructors in the East may not be quite suitable for Western refuse, and doubtless this is the case. Each city has its own problems to solve and it therefore behoves the authority contemplating the installation of a destructor or incinerator to take the fullest possible advantage of the experience of others under similar conditions and of the plant best suited to satisfy its own specific needs.

FOOTNOTES:

(1) Report of the City Waste Commission of Chicago, 1914.
(2) Refuse Disposal in Small Cities and Towns, by Samuel A. Greeley, Illinois Society of Civil Engineers, 1913.
(3) Journal of Cleveland Engineering Society, March, 1914.
(4) Report on Disposal of Refuse, Newark, N.J., 1912.
(5) Surveyor, January 31, 1913.
(6) Brislee. Introduction to study of fuel, 1912.
(7) J. T. Fetherston, New York, Feb. 1914.
(8) Journal of Institution of Municipal and County Engineers, July, 1914.
(9) Refuse Disposal and Power Production, Goodrich.

A patented composition for covering floors, walls, and roofs, and for lining reservoirs, cisterns, baths, etc., consists of one part of Florentine magnesite cement (made by calcining and grinding a volcanic rock found in Tuscany) and three parts of a mixture in about equal proportions of sawdust, ground cork, asbestos, and pumice, and, if desired, ground paper, the whole being mixed with a solution of soft soap.

At Lyons an artificial wood has been devised, consisting in transforming straw into a solid material having the resistance of oak. The straw, after being cut into small pieces, is reduced by boiling to a paste, to which certain chemicals are added. When the paste has been reduced to a homogeneous mass it is put into presses, and planks, beams, laths, and mouldings of all sizes are readily made. This new material can be sawn like natural wood. As a fuel it emits a bright flame and little smoke. It is further stated to be adaptable to the manufacture of matchstems.

HAVING in mind the suggestion looking to the formation of a municipal engineering corps, advanced editorially in our issue of September 2, it is of interest to learn that Mr. George Janin, chief municipal engineer of the city of Montreal, has offered to raise an engineering corps for active service in Europe. As outlined in a letter which Mr. Janin has forwarded to the Minister of Militia, the plan is to organize a corps of about two hundred men, chiefly engineers—and at least those with sufficient technical training to engage in the bridge building, mining and other operations which fall to the lot of military engineers. Each member of the corps, Mr. Janin states, would have a command of both French and English. Mr. Janin is a Frenchman and came to Canada from Paris about twenty years ago. He is now a British subject, and the proposed corps of two hundred men would be enlisted under the British flag. Mr. Janin has both a son and a son-in-law serving under the French colors.

Injection of Cement Grout into Water-Bearing Fissures*

By Francis Donaldson, New York

THE direct injection of cement grout into water-bearing fissures as a means of checking or stopping the flow of water into shafts and tunnels has been experimented with for a decade or longer, and seems to have been first attempted in Europe. It is only lately, however, that the process has been entirely successful. This success has been accomplished on the Catskill Aqueduct, now under construction by the city of New York. This aqueduct includes a number of deep pressure tunnels, reached by shafts for both waterway and construction purposes. In portions of these shafts and tunnels considerable underground water was met. The contract for the first of these tunnels was let to the T. A. Gillespie Company; this section is known as the Rondout syphon. It leads under the Rondout valley at a depth of from 400 to 800 ft., and is about five miles long. The engineers expected that considerable water would be encountered, but fortunately this was not the case except at one shaft, known as No. 4, which penetrated the rock at a junction between limestone and conglomerate.

Water-bearing fissures were encountered almost immediately. At a depth of about 200 ft. a flow of 1,500 gallons per minute was struck. The shaft then contained as many pumps as could be used, and it seemed impossible to sink it further. After vain efforts had been made to proceed, John P. Hogan, a division engineer of the Board of Water Supply, suggested that a cementation of the fissures be tried. The process was attempted for the first time in this country.

Since the shaft was partly full of water it was necessary to drill holes with a diamond drill. Platforms were placed on the timbers at the water level, the diamond drill was installed, and six 90-ft. holes were drilled in the bottom of the shaft. Several car loads of cement were pumped through these holes into the fissures, the drill casings being used for grout pipes. This largely cut off the flow of water from the bottom and sinking could then proceed. After that, water-bearing seams were grouted as soon as encountered, and the contractor was able to finish the shafts and tunnel within the contract time. Shaft No. 4 was a rectangular, timbered construction shaft with no concrete lining; consequently it was impossible to cut off any of the water coming in from above the point where grouting was first attempted. On this account large volumes of water had to be pumped until the tunnel was finally sealed.

At the next wet shaft the writer had to do with, advantage was taken of the experience gained at shaft No. 4. At this second shaft, No. 4 of the New York City syphon, good progress was made until a depth of about 100 ft. was reached. The first hole drilled in the bottom below this depth struck a stream of water; the flow amounted to about 150 gallons per minute. This was plugged. It was found that each of the twelve holes in the sump cut encountered the same stream of water.

As soon as each hole cut the water-bearing seam it was plugged with a tapered wooden plug. After all the holes in the sump had been drilled and plugged in this way the grout connections were made one at a time, so as to restrict the flow of water into the shaft. Each connection was made with a piece of 2-in. or 2.5-in. iron pipe about 3 ft. long, threaded at one end and given a long taper at the other. The tapered portion was made rough on the outside by nicking it with a chisel. A heavy iron stopcock was screwed to the pipe, the tapered end wrapped in several thicknesses of burlap, the wooden plug removed from the drill hole and the tapered pipe driven in, the stopcock being left open. This was the most exciting and the wettest part of the job. After the pipe had been driven in hard the stopcock was closed.

The Grouting Machine

In this case connections were placed in all the wet holes before grouting. The grouting machine or tank used on the aqueduct was the Caniff machine, in which the grout is mixed by air. It is built like an air lock with a door on the top through which cement, sand and water are introduced, and has a 2-in. discharge opening in the bottom and air connections top and bottom. The discharge opening is connected to the grout hole by a heavy rubber hose. Another 2-in. stopcock is placed at the outlet of the tank, and a 2-in. by 1-in. tee is placed between the hose and the cock attached to the pipe in the drill hole. Into the side opening of this tee a 1-in. stopcock is screwed.

The machine is installed at the bottom of the shaft, and is connected to one of the holes and also to the high-pressure air supply. The 2-in. stopcock on the machine is closed and the other is opened. The door in the top is opened, a sack of cement, three or four buckets of water, and (if the cavity to be filled is large) a sack of fine sand are poured in, the air connection at the bottom is opened and the air allowed to bubble through and mix the grout. Then very quickly the door is closed, the lower air connection is closed, and the discharge connection and the upper air connection are opened, and the air enters and drives the grout into the cavity. A man stationed at the 1-in. stopcock keeps opening it a crack; when air shows instead of grout he closes the 2-in. stopcock and the machine is recharged. If the cavity is open the charge is pushed in in three or four seconds. By working continuously more than 1,000 batches can be placed in twenty-four hours.

The grouting of the fissures was successful and sinking was resumed. About 50 ft. further down another water-bearing fissure was drilled into, and this, instead of being open, was filled with sand formed by the crushing of metamorphic gneiss due to folding; this sand was carried up out of the drilled holes in large quantities by the water. Grout will not permeate sand, and it was necessary to continue drilling holes and pumping in grout, increasing the pressure at the end from 100 to 400 and 500 lbs. to the square inch. The sand was tamped so full of cement that when cut through it was compacted like sandstone and contained balls of grout from the size of a fist to as large as a man's head.

The most difficult grouting on the aqueduct was done on the Hudson syphon, which is a deep syphon tunnel under the Hudson River at a depth of 1,100 ft. below tidewater. The shafts were sunk by the city forces, after which the contracts for the driving and lining of the tunnel and lining of the shafts was let. About 150 ft. from the foot of the east shaft the heading cut a water-bearing fissure which flowed about 300 gallons per minute . The full flow did not develop until the cut was blasted. The problem then was to grout this flow against a hydrostatic pressure of 500 lbs. per square inch, with no solid rock to which to make grout pipe connections. This problem was finally solved by the construction of a concrete bulkhead 8 ft. thick across the full section of the head. The concrete was mixed in proportions of 1:2:4, and was heavily reinforced with rails set into holes drilled laterally into the sides, roof and floor of the tunnel. Grout pipes leading into the fissure were set through the bulkhead. After the concrete had set for a week, grout was forced into the fissure, first by the pneumatic process with a high pressure air compressor, and finally by means of a high pressure plunger pump which forced water instead of air into the grout tank. Pressures were reached in this way up to 1,000 lbs. per square inch.

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*From the Transactions of the American Institute of Mining Engineers.

In driving or sinking through rock containing a large number of seams carrying small quantities of water, it is not practicable to stop and grout each seam as described above. In this case it is advisable to increase the section of tunnel or shaft sufficiently to allow for a heavy concrete lining. Drains should be provided opposite all the water-bearing fissures to carry off the water while the lining is being placed. After the concrete has secured sufficient strength, the drains may be grouted. By a combination of these two methods it should be possible to penetrate any firm rock, no matter how much water it contains.

Canadian Contractors and Their Work

Mr. John W. Doty, Montreal

ONE of the most prominent figures in engineering and contracting circles in Canada to-day is Mr. John W. Doty, of Montreal, the active head of The Foundation Company, Limited, of Montreal and Vancouver, a company which specializes in the construction of heavy foundation work, particularly where this involves more than the usual difficulties. Much of the success of the work which this company has done is a result of Mr. Doty's efforts.

Mr. J. W. Doty.

Mr. Doty is the eldest son of the late Fred W. Doty, of Toronto. He was born in the Queen City in 1879 and gained much valuable experience in his earlier days in the shops of the Doty Engine Works. His training for the engineering profession was secured at the Rensselaer Polytechnic Institute, Troy, N.Y., from which institution he was graduated in 1902. Entering the employ of The Foundation Company, New York, in 1903, in seven years he rose to the position of Chief Engineer. In this capacity he designed and supervised the construction of the foundations of many of the largest buildings on Lower Manhattan Island, as well as many important bridges, dams and mine shafts. Of the success of this work a large share of the credit naturally falls to Mr. Doty.

In 1910, he returned to Canada and entered the contracting field by organizing The Foundation Company, Limited, of which concern he is at present the head. This company has built the substructures of many of Canada's largest bridges. Among these are the C. P. R. Bridge over the St. Lawrence River at Lachine, Que.; the C. P. R. Pitt River Bridge in British Columbia, and the Government Highway Bridge at Newcastle, N.B. It has also constructed the foundations for several large buildings, power developments and mine shafts, where the conditions required unusual methods on account of the difficulty of construction, or where speed in operation was the prevailing factor.

The most unique piece of work yet undertaken in Canada—the righting and underpinning of the large grain elevators at North Transcona, Man. (described in detail in our issue of August 19, 1914) was planned and executed under Mr. Doty's supervision.

Mr. Doty lives in Montreal. He is a member of the Engineers' Club and of the Canadian and American Societies of Civil Engineers. He is Vice-President and General Manager of The Foundation Company, Limited, and President of The Doty Marine Engine and Boiler Works, Goderich, Ont.

Mr. Doty is typical of the Canadian who is doing much for Canada by securing the best of the scientific principles and methods of other countries and returning here to apply the knowledge to the development of this country.

Announcement is made of the death of Wm. de H. Washington, consulting engineer, New York City, well known as an expert and enthusiast in highway improvement. The late Mr. Washington was at one time in the Canadian consular service.

The Marathon Rubber Company, of Akron, Ohio, will establish a Canadian branch at St. Catharines, where the ratepayers have approved a by-law granting a factory site and assessment privileges. The company will erect buildings and plant at a cost of not less than $50,000 and will employ 100 men at the outset.

Mr. Ralph Modjeski, the well-known bridge expert of Chicago, has been retained by the Burrard Inlet Tunnel & Bridge Company in connection with the Second Narrows Bridge and is now in Vancouver in connection with the enterprise, gathering data for a report which he will submit at the end of this month.

Sir Donald Mann states that the Canadian Northern Railway programme of construction will be carried out as planned, despite the chaotic conditions brought about by the war. Track-laying north and west of Kamloops will be started at an early date, and steel laying from the eastern end of the construction is to be continued. The large force of men engaged in grading and other work will be kept employed. The section between Toronto and Port Arthur is practically completed. Steel is delivered for all the line in British Columbia. In this province the company has three thousand men at work.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The Toronto city council will expend $480,000 on a garbage disposal plant. The scheme embraces disposal plants in three or four sections of the city.

Tenders have been called for the $100,000 city hall which is to be erected at Lachine, Que. The architect for the proposed building is Mr. J. E. Viau, Montreal.

Among recent Quebec charters we note that of La Compagnie de Construction de Maison d'Habitation Salubres, Limitee, Montreal, with a capital of $100,000.

The Hamilton Board of Trade has pledged itself to raise the money necessary to undertake the erection of the new Connaught Hotel, estimated to cost one million dollars.

Foundation work has been completed for the new church which is to be erected at Quebec for the Redemptorist Fathers. The construction of the building will be frame and stone. The architect is Mr. R. P. Lemay, Quebec.

Opinion is gaining ground that work on the Toronto-Hamilton permanent highway will be started in the near future. It is expected that the undertaking will give employment at the outset to not less than five hundred men.

Operations are in progress on the new Charlotte Street school building which is being erected at London, Ont., at a cost of $100,000. The general contractors are J. Moran & Son. The building will be two-storeys high, of brick construction.

Plans for an extension of No. 2 elevator of the Montreal Harbour Commission have been submitted to the Commissioners. An addition was recently made to the eastern portion of this elevator, and the proposed extension is to be on the western side.

Constructional operations are well advanced on the apartment block which Messrs. Port Arthur Buildings, Limited, are erecting at Port Arthur. The general contractors are Messrs. Marsh, Hutton & Power Company, Limited, Port Arthur. The building is to be of reinforced concrete terra cotta and brick construction.

In view of present unsettled conditions, the directors of the National Brick Company of Laprairie, Montreal, have decided to defer payment of the dividend on the common stock. The opening months of the season promised a very satisfactory amount of business, but with the declaration of war, orders fell away, and the directors naturally desire to husband their resources. The Delson Junction plant is still in operation.

At a meeting of the Montreal Builders' Exchange called with a view to considering the situation brought about by the war, there was much discussion of the problem of getting money from the banks and securing cheaper labor. Several contractors declared that building cost more in Montreal than in any other city on the continent, owing to the high cost of land, labor and materials. Incidentally it was mentioned that the Unions would allow of no cut in wages, and that the men would rather lie idle than permit any reduction of the present scale. Mr. John Quinlan criticised severely the whole system of financing building operations on borrowed money. He said that the solution of the problem was the issuance of small bonds so that people with money in the banks could invest in them at a better rate than the banks allowed. The Exchange elected a committee to draw up a definite plan of action and report at a later meeting.

The town of Joliette, P.Q., is about to improve its water supply, plans having been drawn up by Messrs. Surveyer & Frigon, civil engineers, Montreal. The present power house is to be altered, and two hydraulic pumps (each of a capacity of 1,000 gallons per minute), and a turbine are to be installed. The pumps will work at a pressure of 130 lbs. The dam on the L'Assomption River is to be rebuilt of concrete. The platform of wood is to be substituted by one of concrete. A wood stave penstock, 6 ft. in diameter, is to be constructed in place of the open flume. Concrete walls are to be built on both sides of the channel and new head gates placed in position. The whole work will cost about $50,000.

Messrs. Routly & Summers, of Toronto and Huntingdon, P.Q., have secured one of the largest surveying contracts of the season. This is to survey the contour of the new flowage above the Iroquois dam of the Abitibi Pulp and Paper Company. A little over a year ago Messrs. Routly & Summers surveyed the contour at elevation 820. The flooding then extended to McDougal's chutes at Matheson on the Black River and to Twin Falls on the Abitibi, distances of 20 and 11 miles above the dam. The height to which it is now proposed to raise the water will flood out both these falls and reach about seven miles above Matheson on the Black River, and ten miles above Twin Falls on the Abitibi. Messrs. Routly & Summers have Haileybury and Porcupine districts, and are now engaged on a large road contract in Huntingdon County. Both members of the firm are aggressive young Canadians—graduates of the School of Science, Toronto.

WESTERN CANADA

The Universal Drilling and Contracting Company, Limited, has been incorporated at Calgary with a capital of $1,000,000.

Moose Jaw, Sask., is the headquarters of the newly incorporated Anchor Elevator Company, Limited, which is capitalized at $100,000.

The Burrard Inlet Gravel & Dredging Company, Limited, Vancouver, is among the latest incorporations in British Columbia. The capital is $10,000.

The British Columbia Steel Works recently incorporated at Vancouver has acquired five acres of land, with three hundred feet of water frontage at Bridgeport, Lulu Island.

The city of Calgary has decided to proceed with its various constructional operations in the municipal field. The programme involves the expenditure of approximately a million dollars.

A start has been made upon the new provincial parliament buildings which are to be erected at Manitoba, at a cost of $2,000,000. The dimensions of the buildings will be 340 ft. by 320 ft. and the construction will be of Manitoba stone. The architect is Mr. F. W. Simon and the general contractors are Thos. Kelly & Sons, Winnipeg.

Work is well advanced on the three-storey brick apartment block which S. Lobel is building at Wolseley and Lipton streets, Winnipeg, at a cost of $100,000. The general contractor is H. Genser, of Winnipeg.

At Medicine Hat, operations are proceeding on the erection of the new plant of the Saskatchewan Bridge & Iron Company, Limited. When the plant is completed and equipped it will represent an investment of approximately $200,000.

The Imperial Oil Company, Limited, of Vancouver, have applied to the city council of Victoria, B.C., for permission to erect a fireproof storage plant in that city. The application has been considered favorably, and negotiations are proceeding.

The substructure of the new bridge which is being erected on Eighth Avenue, Moose Jaw, by the City Council and the Canadian Pacific Railway, is completed. The total cost of the bridge is placed at $109,000. The general contractors are Messrs. Carter-Halls-Aldinger Company, Winnipeg.

Work is in progress on the Alberta and Great Waterways Railway undertaking, for which the J. D. McArthur Company, Winnipeg, are the general contractors. Twenty-five miles of steel have been laid and ninety-five miles of grading have been completed. The cost of the undertaking is placed at five million dollars.

Foundation work is in progress on an apartment block which is being erected at Winnipeg by Mr. Daykin Scott, the owner and general contractor. The building will be four storeys high, 50 ft. by 140 ft. in dimensions, of brick construction. The cost is estimated at $100,000. Mr. E. Pain, of Winnipeg, is the architect.

Book Reviews

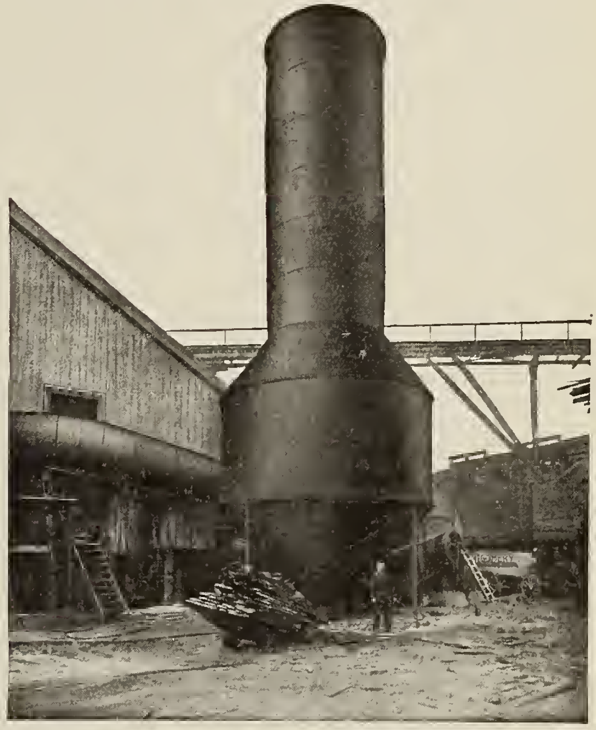
HISTORY OF BRIDGE ENGINEERING, by Henry Grattan Tyrrell (University of Toronto) Chicago. Price $5. The latest issue of this valuable work contains 480 pages and 330 illustrations. This book is valuable, not from a historical viewpoint alone but also as a work of reference, especially in the selection of economic types and the preparation of comparative designs and estimates. The majority of the illustrations are from original diagrams, sketches and photographs. Generally it may be said that this is a practical book of exact data, full of suggestions and information for engineers, contractors, designers and others identified with this particular branch of constructional activity. It being the only book on the subject in the English language, Tyrrell's History of Bridge Engineering may be accepted as a standard authority in this field.

Several million yards of Trinidad and Bermudez sheet asphalt pavements that have given a service of twenty years or more are illustrated and described in a booklet entitled, "Evidence," just published by the Barber Asphalt Paving Company. A score of cities are represented and wherever maintenance data were obtainable they have been given along with the date the pavement was laid and a photograph showing its present condition. The oldest of the pavements so described is the Trinidad sheet asphalt on Vermont Avenue, Washington, D.C. It is 35 years old. Something more than 1,000,000 square yards of asphalt paving in Washington, D.C., averaging 23 years of age, have cost 1.8 cents per yard per year for maintenance. New Orleans has several 30-year pavements. Buffalo has 1,200,800 yards of sheet asphalt 20 years of age or more and still in use. Among other cities that contribute to the census of more-than-20-year-old pavements are New York, Philadelphia, Boston, Chicago, St. Louis, Cincinnati, Columbus, Detroit, Omaha, Charlestown, S.C., Savannah and Louisville.

Unique Mechanical Draft Installation in a Lumber Mill

The Bloedel-Donovan Company, of Bellingham, Wash., have recently installed an unique and successful induced draft apparatus. The magnitude of the installation can only be appreciated by comparing it with the horse and wagon standing beside it, the wagon being only about one-half the height of the fan, while the collector is larger than an ordinary house.

This apparatus is guaranteed to collect all sparks and cinders. This entirely eliminates the fire risk. Cinders are caught in the collector and are diverted into a flume of water which empties into Puget Sound. The apparatus also enables the owners to keep clean lumber in their yards. They state that it will save them thousands of dollars a year for that reason. The cinders settling on the lumber together with the rain discolors the wood and greatly reduces its market value. This appearance is used in connection with boilers burning shavings and saw mill refuse. At the time the photograph was taken the boilers were delivering 2,300 h.p., which is greatly in excess of their normal rating. This increase in boiler capacity is due to the tremendous additional draft obtainable with the induced draft system. In some plants as much as 100 per cent. additional capacity is obtained by using mechanical draft.


Induced draft apparatus in a lumber mill (B. F. Sturtevant Company's installation).

Another advantage obtained is that steam pressure is kept constant at any desired pressure. When steam pressure tends to decrease the fan speeds up automatically and does not allow pressure to drop. This enables the plant to respond instantly to sudden demands for more steam. If another engine were thrown in there would be plenty of steam. With this system, steam can be raised from cold water very quickly.

The installation was made by the B. F. Sturtevant Company, of Hyde Park, Boston, Mass.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Chatham, Ont.

The Waterworks Commissioners contemplate the laying of a 12-in. water main across Thames, also the putting down of three street hydrants. Estimates will be prepared. F. B. Adams is the engineer, and W. G. Merritt, city clerk.

Edmonton, Alta.

Edmonton, Dunvegan & B. C. Railway has offered to finance the construction of an 18-ft. pavement from Edmonton to their engineering shops, St. Albert Trail.

Esquimalt, B.C.

The municipal council is having plans prepared for construction of sewage system in Craigflower District, consisting approximately of five miles of sewers. Tenders for work will be called as soon as plans are ready. E. A. Ellis is clerk, and C. A. Toff, 211 Pemberton Block, Victoria, is engineer.

London, Ont.

Tenders will be received by Board of Control until 9 a.m. September 18th, for construction of the following vitrified sewers: approximately 1,029 ft. of 10-in. sewers with 20 manholes; 2,329 ft. of 8-in. with 20 manholes; 6,646 ft. of 6-in. private drain connections, also connections with gasket and cement joints. Plans and specifications at office of Engineer, Wm. N. Ashplant.

Tenders are being asked for construction of sanitary sewers as follows: Belgrave Ave., from Duchess to Grand Ave., Carfrae Cres., from Grand Ave. to Carfrae St., Gordon St., from Cheapside to end of street; Carlton Ave., from William St. to end of street; William St., from Grosvenor to Cheapside St. Plans and specifications at office of Engineer, Wm. N. Ashplant.

H. J. Glaubitz, Engineer, waterworks plant, is in the market for two water wheels, turbine, pumps and motors.

Millardville, B.C.

The ratepayers have passed a by-law providing for laying of watermains in Rochester and Austin Roads. E. H. Longly is municipal engineer.

A by-law for construction of water system at an estimated outlay of $8,499 has been defeated by the ratepayers.

Ottawa, Ont.

The report of Waterworks Engineer has been passed by city council for carrying out of $50,000 repairs to intake pipe. The work provides for (1) unwatering aqueduct other than by pumping; (2) connection of 40-in. and 42-in. pipes; (3) use of rock bolds throughout. Tenders may be called shortly.

Work is to start at once by day labor in connection with laying of a $13,000 pavement on Gilmour street for city council. F. C. Askwith is city engineer, L. McL. Hunter roadway engineer.

Bids received by city council for supply of concrete mixer have all been rejected and new tenders will be called.

Plans are drawn for the construction of wood block pavement on Augusta St., between Henry and St. Patrick, at estimated cost of $17,000. Quantities are, blocks, 3,600 sq. yds., curb, 350 lin. ft., headers, 145 lin. ft.

Regina, Sask.

The city council is trying to raise $50,000 for completion of reservoir of 5,000,000 gal. capacity, steel and concrete construction. J. M. McKay is superintendent of Waterworks Department.

The city council contemplates the construction of sewers and water mains to cost approximately $20,000, work to be done by day labor. Engineer is F. McArthur.

Stratford, Ont.

The Water Commissioners are commencing work on the construction of a 6-in. water main on Albert St. R. R. Lang is city clerk, and W. H. Trethway, sec.-treas. of Water Commissioners.

South Vancouver, B.C.

Plans have been approved by municipal council for carrying out of paving on 63rd Ave., from Ross to Main St., with gravel bitulithic 18 ft. wide, also other improvements to Manitoba St. Estimated cost $2,986.

Toronto, Ont.

Tenders are wanted for construction of several house drains in the east end, by A. McLeod, 57 Benlamond Ave.

The city council has adopted a scheme to construct a series of three or four incinerators in different parts of the city, at an estimated cost of $480,000, as recommended by the Board of Control. The scheme provides for total incineration of all garbage and refuse. Three projects were before the council, the other two being suggested plans (1) for total incineration in two incinerators, and reduction of garbage outside city, at an estimated cost of $676,000; (2) total incineration of rubbish and reduction of garbage in central plant located at Ashbridge's Bay. The estimated cost of this latter was $720,000. Tenders will be called as soon as plans are completed.

Work will be started shortly on the construction of concrete road to connect Toronto and Hamilton. Toronto will be asked to contribute $125,000 and Hamilton, $50,000, while the townships will be expected to subscribe $160,000 and approximately $140,000 will be raised by capitalizing an annual frontage and acreage tax.

Vancouver, B.C.

The municipal engineer, F. C. Fellowes, has submitted plans for construction of sewer in Alma Road, 40-in. in diam., from 4th to 7th Ave., and 30-in. diam., from 7th Ave. to Broadway, at an estimated cost of $15,000; also a sewer in Trinity, from Slocan to Nanaimo Sts., at a probable expenditure of $6,500. Mr. Fellowes has also recommended construction of sewers as follows: 19th Ave., to cost $1,600; 21st Ave., $3,800; 22nd Ave., $4,600; 23rd Ave., $3,400; 24th Ave., $2,850; and Carolina St., $8,500. Wm. McQueen is the city clerk.

City Engineer has completed estimates for constructing 42-in. sewer on Alma Road; cost $15,000, and a sewer on Point Grey Road, to cost $15,500.

Vernon, B.C.

Plans for construction of sewer extensions and disposal works for city have been approved by Provincial Board of Health.

Victoria, B.C.

A by-law has been carried for the construction of asphalt pavement on Dallas Road, between Erie and Simcoe Sts., and operations will start at once. Wellington J. Dowler is the clerk.

Welland, Ont.

A water pipe line costing $1,000,000 will be constructed according to press reports, by the Dominion Government. The line will carry water from Lake Erie to supply the towns of Welland, Merriton and Thorold, Port Robinson and Allanburg and the city of St. Catharines.

CONTRACTS AWARDED

Cayuga, Ont.

The contract for 1,800 sq. yds. of pavements has been given by the Town Council to Crofft & Walters, Cayuga, at $1,200. J. W. Sheppard is the Clerk and Mr. Kidd, Dunville, Engineer.

Eastview, Ont.

The contract for construction of sidewalks on various streets has been let to Loomis, McBean & Williams, Sussex St., Ottawa. Patterson & Byrne, Sparks St., Ottawa, are the engineers. Vitrified clay pipe will be required.

Esquimalt, B.C.

The contract for construction of sewer system in District "C" at a cost of $15,000, has been awarded by the municipal council to Hugh MacDonald, general contractor, at Victoria.

Kingston, Ont.

The Board of Works has recommended the award of contract for asphalt pavements on William, Aberdeen & Frontenac Sts., and University Ave., to Foley & Gleeson, Central Chambers, Ottawa, at $2.15 per sq. yd.

Ottawa, Ont.

General Supply Co. of Canada, Ltd., 356 Sparks St., has been awarded the contract for supplying Trench Rammer for city council.

Richmond, Que.
The municipal council has awarded the contract for ½ mile bituminous macadam road and about 2 miles water-bound macadam road, also about 37,000 lin. ft. of concrete walk, to Cairnie and St. George, 4 Hospital street, Montreal.

Toronto, Ont.
The Board of Control has awarded the following contracts for paving: A. J. Penberthy, 292 Booth Ave., Ashdale Ave., $1.11½; Ellsworth, $1.11½. Grant Contracting Co., 50 Front St. E., Clendennan, 70c; Leonard, 70c; Wade, $1.08. Ramsay Contracting Co., 39 Indian Rd. Cres., Fort Rouillee, $1.10½. Routly & Summers, 47 Sparkhill Ave., Queen St., S.S., $1.10½. Constructing & Paving Co., Confederation Life Bldg., concrete curbing on Norman Ave.

The following contracts for Rocmac pavements have been awarded by the Board of Control: Asphaltic Concrete Co., Toronto, Gilbert Ave., $12,669; McRoberts, $11,171; Beech, $9,820.

The Board of Control has awarded the contract for asphalt on the following streets, totalling $73,680, to R. C. Harris, Commsr. of Works: Caledonia, $9,270; Columbine, $6,222; Logan, $11,593; McRoberts, $6,443; Moscow, $8,852; Muriel, $5,353; Myrtle, $2,500; Norman, $4,158; O'Connell, $3,271; Ozark, $6,065; Spadina, $9,944.

Thorald, Ont.
The town council will call for tenders shortly for sewers on Elgin, Queen, Richmond, Albert and Metcalfe Streets. D. J. Munroe is the clerk.

Winnipeg, Man.
Tenders close September 29 in connection with contract for sewers on ten streets. Plans are at office of Works Department, City Hall.

Railroads, Bridges and Wharves

Edmonton, Alta.
Work is in progress by general contractors J. D. McArthur Co., Winnipeg, on construction of $5,000,000 railroad to Fort McMurray for Alberta & Great Waterways Railway. Twenty-five miles of steel have been laid and 95 miles of grading completed.

Hamilton, Ont.
Work is to recommence on concrete bridge over Cross street for the town council. Cost $2,000.

Montreal, Que.
The Montreal Locomotive Works is constructing twelve locomotives for the Grand Trunk Railway, for the accommodation of suburban service.

North Vancouver, B.C.
Geo. Long of the Dominion Shipbuilding & Dry Dock Co., Ltd., Vancouver, writes that specifications are not yet complete for buildings and machinery for proposed North Vancouver dry dock. Bids will be called for later on. Concrete foundation, shipways and dredging being done by B. C. Granitoid & Contr. Co., Ltd., Vancouver.

Sarnia, Ont.
The town council is considering a suggestion by the Pere Marquette Railway that they be supplied with site for new station.

Business Buildings and Industrial Plants

Barrie, Ont.
The architect, Elliott G. Strathy, 123 Simcoe St., Toronto, has prepared plans for stores and apartments to be erected on Elizabeth St., at a cost of $8,000. Owner and general contractor, D. Waisburg, 106 Dunlap St. Sub-contracts are not yet let, and work will be done this fall. Building will be 2-storeys, 34 x 60, brick construction, concrete and stone foundation.

Caledonia, Ont.
Plans are in progress for constructing 3 buildings for Caledonia Fair Board.

Calgary, Alta.
Separate tenders close with architect, Chas. Hay, 202 Oddfellows Bldg., 10 a.m., September 21st, for masonry, carpentry, plumbing, electric wiring, roofing, plastering and painting in connection with construction of warehouse and offices for Western Canada Cordage Co., Ltd. Tenders for heating will be called later.

Guelph, Ont.
Tenders will be called by Architect W. A. Mahoney, Telephone Bldg., in a few days for contract to erect a 2-storey brick skating and curling rink on Baker St., at an estimated cost of $12,000, for the Victoria Skating Rink.

Plans are in preparation for rebuilding of Victoria Skating Rink. W. A. Mahoney, Telephone Bldg., is the Architect, and J. A. Little, Secretary. Work is to be done this fall.

Lindsay, Ont.
Plans have been completed for extension of post office tower on Kent St., to additional height of 24 ft. by the Dominion Government Department of Public Works.

Lynn Creek, B.C.
The Dominion Shipbuilding & Drydock Co., North Vancouver, B.C., has, it is reported, secured a site of 140 acres. It will establish a plant estimated to cost about $5,000,000. Machine shops will be built first.

Montreal, Que.
The architect, F. T. Jackalin, Room 5, Jacobs Bldg., will call for tenders shortly for general contract in connection with alterations and addition to Victor Theatre on St. Lawrence, near St. Catherine St. Estimated outlay $8,000. Building will be 90 ft. high, 40 x 45 ft., steel, stone and brick construction, felt and gravel roofing.

Preliminary sketches have been drawn and plans will be started at once, by architect F. T. Jackalin, Room 5, Jacobs Bldg., for erection of a $60,000 theatre on St. Catherine and Peel Sts. Owner's name is not available. Building will be 60 ft. high, 55 x 100 ft., steel and brick construction, concrete foundation.

Owen Sound, Ont.
E. D. Pitt, architect, and Major Gillette, consulting engineer, Philadelphia, Penn., are preparing plans for a drydock and ship building plant to cost $1,500,000.

Regina, Sask.
Plans being prepared by Story & Van Egmond, Regina, for a 3-storey store and apartment house, of slow burning construction, to be erected on Albert St. and 13th Ave.; cost $45,000.

St. Catharines, Ont.
Kremer & Griffin, Buffalo, N.Y., have secured a site on Carleston St., where a silk factory will be erected.

Toronto, Ont.
Owner and general contractor Wm. Smedley, 353 Spadina Ave., desires tenders for excavating about 150 cu. yds. in connection with a 2-storey brick addition to stores, 353 Spadina Ave. Work will be done by day labor.

General contractor A. McLeod, 57 Benlamond Ave., calls for tenders on plastering $20,000 store at 292 Yonge street, for C. F. Tugman. Building is three storeys, brick construction.

Tenders will be called shortly for construction work on office building, to be erected at 192-4 University Ave., for Provincial Hydro-electric Commission, at an estimated cost of $300,000. Secretary, W. W. Pope, Continental Life Bldg., W. H. Thomson is doing the excavating.

Windsor, Ont.
Morton & Fowell are to add a garage, 1 storey, frame and brick construction, to their stores and offices on Pitt and Goyeau streets.

CONTRACTS AWARDED

Aylmer, Ont.
The general contract for construction of front for furniture store for J. M. Farthing, Talbot street, has been awarded to H. J. St. Clair Co., Ltd., A. B. Ormsby Co., Ltd., are contracting for galvanized iron.

Camrose, Alta.
The contract for constructing a $5,000 warehouse for Imperial Oil Co., Tegler Block, Edmonton, has been awarded to George Hardy, Camrose. Building will be 40 x 40, 1-storey, concrete foundation, mill and fireproof construction.

Elmira, Ont.
The general contract for installing a dough mixer and sifter for Casper Stumpf has been given to Wm. & J. C. Greey, Toronto.

Montreal, Que.
The general contract for the construction of alterations to stores and residences on Beaver Hall Hill, estimated to cost $3,000, has been awarded to Raymond Construction Company, 46 St. Alexander Street. E. Payette, 103 St. Francois Xavier Street, is the architect.

Ottawa, Ont.
The General Supply Co. of Canada, Ltd., 356 Sparks St., has been awarded the general contract for supplying 2 tarvia storage tanks for City Council.

Toronto, Ont.
The Board of Control has awarded the following contracts for 2½-in. fire hose: Gutta Percha & Rubber Co., and Dunlop Tire & Rubber Co., 2,500 ft. at $1.05 per ft.; Goodyear Tire & Rubber Co., 2,000 ft., at 95c. per ft.

The contract for hot water heating system for Womens' Building, Industrial Farm, has been given to Fred Armstrong Company, Toronto, at $926, by the Board of Control.

In connection with the construction of

a Jail building on Yonge Street North, the Board of Control has awarded the following contracts: Masonry, Teagle & Son, 55 Boswell Avenue, $47,500; carpentry, W. S. Henry, 506 Dovercourt Road, $6,448; roofing, A. Matthews, Ltd., 256 Adelaide West, $1,593; plumbing, heating and wiring, Fred Armstrong Co., 277 Queen Street West, $14,500; plastering, John Bryce, 15 Jersey Avenue, $240; painting, R. Morse, 186 Avenue Road, $1,075. The building will be two-storeys and basement, 200 ft. by 65 ft., reinforced concrete and brick construction.

Welland, Ont.

The general contract for alterations to opera house has been awarded to Wm. Mitchell, 120 Aqueduct Street. The building will cost $5,000 and will be three storeys, brick construction. W. E. Buckingham, Douglas Street, Guelph, is owner, and T. L. Nichols, 18 Main Street South, architect.

Windsor, Ont.

The masonry contract for an addition to grandstand for Windsor Jockey Club at a cost of $15,000, has been awarded to Thompson Bros. The stand will be 120 ft. long, concrete and steel construction. Smith, Hinchman & Grylls, Washington, are the architects.

Public Buildings, Churches, Schools, etc.

London, Ont.

Tenders are in and contract will be awarded shortly for a 2½-storey parsonage, solid brick construction, concrete foundation. Estimated cost $8,000, for Dundas Centre Methodist Church. McBride & Gilbert, Edge Block, Dundas and Richmond Streets, are the architects.

Tenders will be received by Architect J. V. Munro, Bank of Toronto Chmbrs., until Sept. 23rd, for hot water heating, plumbing, hardwood floors, and tile mantels in connection with alterations and addition to St. Andrews Presbyterian Manse, Queen's Ave.

Lachine, Que. (Montreal)

Bulk or separate tenders will be received until 5 p.m. September 17th, for digging work, concrete, curb stone, brick work, structural steel, carpentry and joinery, roofing, copper and galvanized iron work, plumbing and ventilating, in connection with erection of City Hall on St. Joseph St. and 18th Ave., at cost of $100,000. H. C. Charette is secretary; J. E. Contant, 373 St. Joseph St., Lachine, assistant city clerk; and J. E. Viau, 76 St. Gabriel St., Montreal, architect. Plans and specification are at office of assistant clerk and architect.

Niagara Falls, Ont.

Plans for church on Jepson St., at an estimated cost of $18,000, are to be changed by architects, Burke, Horwood & White, Ryrie Bldg., Toronto, the object being to reduce cost. New tenders are now to be called.

St. John, N.B.

The site of St. John's County Tuberculosis Hospital has been staked off on Municipal Home property by F. Neil Brodie, architect. Excavation has been started by contractors, A. R. C. Clark & Sons.

Sudbury, Ont.

Prices and samples wanted at once on stained glass, asbestos shingles and flooring, by architect and general contractor, W. H. Owens, Room 6, Baikie-Gill Blk., in connection with $20,000 addition to church on Notre Dame for St. Ann's Parish.

Simcoe, Ont.

In connection with the construction of a parish hall for Trinity Church Congregation at cost of $10,000, the general contractors, D. D. & L. A. Gunton, are ready to purchase $400 worth of Indiana cut stone for sills and caps. Barber & Tilley, Temple Bldg., Brantford, are the architects.

Tilbury, Ont.

The town council has passed a resolution to petition the Government to erect a new armoury.

Toronto, Ont.

Tenders are invited by Architect, A. McLeod, 57 Benlamond Ave., for plastering in connection with alterations to Emmanual Presbyterian Church, at a cost of $12,000.

The Advisory Committee, Board of Education, has decided to use cut stone instead of terra cotta on Commercial High School building. The contract for the work has been awarded to R. Robertson & Son, for $107,000, this amount being $14,000 in excess of original contract which specified terra cotta.

The Separate School Board has decided to construct a new separate school in vicinity of Westminster and Sorauren Avenues. Rev. Fr. Mineham is interested in the project.

Vancouver, B.C.

New tenders may be called later by the architects, Braunton & Liebert, Exchange Building, for the construction of a $20,000 synogogue on Melville Street. Building is to be two-storey, frame and brick construction.

Competitive plans will be received by Sec., Vancouver Civic Centre Committee, c/o Board of Trade, 543 Hastings St., W., until November 30th, for Civic Centre buildings, estimated to cost $1,000,000. Premiums of $500 and $250 will be awarded for designs placed first and second, respectively.

CONTRACTS AWARDED

Brantford, Ont.

W. S. Jago, 66 St. Paul Avenue, has been awarded the general contract for a $3,400 parsonage, red brick construction, on Oxford Street, for Methodist Church of Canada. Sub-contracts for heating, plumbing and electrical work have not yet been let. F. C. Nicholson, 43 George Street, St. Catharines, is the architect.

Cookstown, Ont.

The general contract for church, brick construction, for Cookstown Methodist community, has been awarded to Geo. Sainsbury, Coulter Ave., Weston. Burke, Horwood & White, Ryrie Bldg., Toronto, are the architects. Secretary, W. J. Finlay.

Fonthill, Ont.

Harvey & McCoombs have been awarded the contract for $2,500 residence, two-storeys, brick veneer construction, cement foundation, for Mrs. Melinda Farr.

Mount Dennis, Ont. (Toronto)

The congregation of Mount Dennis Presbyterian Church has awarded the following contracts for the erection of church on Guest Ave. Masonry, F. & A. E. Ham, Toronto; carpentry, Bert Deakin, Mount Dennis. The building will be brick construction, the basement only being erected at present. S. B. Coon & Son, Ryrie Bldg., Toronto, are the architects.

Quebec, Que.

The following sub-contracts in connection with the three-storey steel and sandstone Presbytery building on St. Joseph Street, at a cost of $38,000 for the Parish of St. Roch, have been awarded: Carpentry, Achille Dugal; steel, Masson, Limited. Jos. Villeneuve, 299 Prince Edward Street, is general contractor.

Vancouver, B.C.

The contract for constructing concrete retaining wall around Beaconsfield School, on 20th Ave. and Clinton St., at an outlay of $5,292, has been awarded by the School Board to Baker & Ellicott, 52 Leigh Spencer Bldg.

The school board has awarded the contract for the supply and erection of iron fences around the Dawson and Model Schools at $1.10 per lin. ft. to Dominion Ornamental Iron Works, 5th St. W., Vancouver. Gerald Upton is school board secretary.

Residences

East Kildonan, Man. (Winnipeg)

The building of a number of residences is under consideration by C. G. Berry, 622 Polson Avenue.

A permit has been issued for the erection of a $2,200 two-storey brick residence on West Columbia street for O. Denis, 762 Maisonneuve.

Fonthill, Ont.

Plans are drawn by the owner and architect, C. Fisher, for a $2,500 residence. Building will be two storeys, frame construction, concrete foundation.

Hagersville, Ont.

A site has been selected and plans are in progress for the construction of a brick residence on Main street for Richard Winger.

Montreal, Que.

Contracts will be awarded and work is to start October 1st on alterations and addition to residence on Mansfield street for Height of Fashion Ladies Tailoring, 630 St. Catherine W. D. J. Crighton, Jacobs Bldg., is architect.

The general contractor, A. F. Byers & Company, 340 University Ave., is taking prices on roofing and tiling of two residences on Dorchester Street West, for Dr. R. E. Powell, 1363 Green Ave. Blanchard & Conrad, 3 Beaver Hall Sq., are the architects.

In connection with the construction of a nurses' home on Charles Street, for the Alexandria Hospital, A. F. Byers & Company, general contractors, are taking tenders on painting, plastering, roofing and iron.

A permit has been issued for the carrying out of alterations to residence of Chas. Lesage, 780 Dorchester East, at an estimated outlay of $4,000.

Notre Dame de Grace (Montreal) Que.
The owner and general contractor, Mr. T. C. Ogilvie, 441 Bleury street, will let sub-contracts for roofing and painting two stone and brick residences on Grey Avenue, which are being constructed at a cost of $40,000. Owner is not yet ready for the reception of tenders.

Norwood, Man. (Winnipeg)
The construction of several residences in 1915 is contemplated by J. Johnson, 121 Kitson street, Norwood.

Ottawa, Ont.
Mr. T. D. McFarlane, 307 Gilmour street, contemplates the erection of a residence on Gilmour street.

Outremont, Que.
Tenders for painting $15,000 cottage on Outremont Ave. for P. P. Boileau, St. Viatur street, will be called in about a week.

Paris, Ont.
The erection of a residence on Reynolds Survey is contemplated by Jas. D. Findlay.

Sherbrooke, Que.
A permit has been issued to J. E. Goodhue, Victoria St., for construction of a 2½-storey brick residence on Victoria St., at estimated cost of $4,872. F. X. Lefebvre & Co., 10 Wilson St., are the general contractors.

Toronto, Ont.
A permit has been issued to Mr. C. Jones, 573 Sherbourne street, for the erection of a detached 2½ storey brick residence on Jackman Avenue, at an estimated outlay of $4,000.

A permit has been issued for carrying out alterations to the residence of Mr. R. L. Cowan, 3 Rowanwood Ave.

Winnipeg, Man.
Mr. D. James, 249 Notre Dame, is contemplating the erection of a number of residences during 1914.

Mr. A. J. Gibson has under contemplation the erection of a number of residences.

The construction of several residences in 1915 is contemplated by W. L. Purcer, 509 McIntyre Block.

Standard Securities, 500 Great West Permanent Building, contemplate the erection of a number of residences in 1915.

In connection with construction of 2 residences at 136-8 Glenholme Ave., tenders are wanted on wiring, plastering, drains, concrete work, painting, and hot air heating. Mr. Nicholls, 136 Glenholme Ave., is the foreman.

Plans have been drawn for three attached residences on Connolly Ave., at an estimated cost of $5,000, for B. Cohen, 60 Edward street, owner and general contractor. Work will be two storeys, brick construction.

Plans are drawn for two 2½ storey brick residences on Arundel, near Danforth Ave., at an estimated cost of $8,000, for Geo. Lucas, 919 Carlaw Ave., owner and general contractor. Contract for smaller trades will be let.

Permits have been issued to A. E. Miller, 133 McRoberts Avenue, to erect a $2,000 residence, brick construction and foundation.

Winnipeg, Man.
Jordan Realty Company, 408 Sterling Bank Bldg., contemplate erecting a number of residences next spring.

CONTRACTS AWARDED

Cote des Neiges, Que. (Montreal)
The sub-contract for roofing, heating and plumbing in connection with the construction of the three-storey, 50 ft. by 40 ft. brick veneered cottage for A. Legare, Cote des Neiges West, has been let to E. Lesperance, 244 Clarke street. Sub-contract for electrical work has not yet been let. The architect is J. A. Karch, 187 St. Denis street.

Montreal Que.
The sub-contract for roofing in connection with the alterations to the residence of H. V. Meredith, 526 Pine Ave. West, at a cost of $32,000, has been awarded to McFarlane & Douglas, Ottawa. The architect is E. W. S. Maxwell, 6 Beaver Hall Square, and the general contractors, Norcross Bros. Co.

Ottawa, Ont.
The contract for alterations to the residence of Jos. Seguin, 30 Water St., at a cost of $3,000, has been awarded to Olva Rose. The work will be brick veneer construction, felt and gravel roofing.

Sub-contracts in connection with alterations and additions to apartments on Laurier and King, at a cost of $35,000, for Doran & Delvin, 90 Somerset St., are: heating and plumbing, A. Gauthier & Company; electric wiring, etc., Marchand & Donnelly. The building is stucco and brick construction.

Outremont, Que. (Montreal)
The sub-contract for plastering a $15,000 cottage on Outremont Ave. has been let to Depatie & Lapierre, 2077 St. Urbain street. The painting contract has not yet been let.

The following contracts have been let in connection with the construction of an apartment house on Van Horne Ave., at a cost of $20,000; masonry, carpentry and interior fittings, day labor; roofing, heating and plumbing, J. St. Amand; plastering, J. E. Emond; electrical, J. Brien; painting has not yet been let. The building will be three storeys, stone and brick construction.

Point du Mois, Man. (Winnipeg)
The city of Winnipeg has awarded the general contract for four cottages to C. W. Laird, Winnipeg, at $5,565.

St. John, N.B.
The sub-contract for woodwork in connection with the $5,000 addition to residences on Princess and Carmarthen streets for J. L. Thorne, has been awarded to Murray & Gregory, Douglas Avenue.

Welland, Ont.
The contract for repairing residence and workshop for John McCaw, 135 Hellems Ave., has been given to Ryan & Gardiner.

Power Plants, Electricity and Telephones

Niagara Falls, Ont.
The Electric Light Department of the City Council is contemplating the purchase of a Circuit Breaker for the Electric Light plant.

The Electric Light Department will probably purchase poles for electric light line, at estimated outlay of $1,000. W. J. Seymour is the clerk.

Ottawa, Ont.
Plans are in progress for construction of pump on Queen Street. R. L. Haycock, Waterworks Engineer, is in charge of the work.

CONTRACTS AWARDED

Toronto, Ont.
The City Council has adopted the report of Board of Control awarding contract for two 24,000,000 gallon pumps for main pumping station, to Turbine Equipment Co., Ltd., Toronto.

Montreal, Que.
A. B. See Electric Elevator Company of Canada, Limited, has obtained the contract for two elevators for the Merchants Bank of Canada, 205 St. James Street.

Niagara Falls, Ont.
The Northern Electric Co., Ltd., 131 Simcoe St., 8oronto, has been awarded the general contract for cable and wire, etc., for complete separate line to Dominion Chain Co., at $4,000.

Toronto, Ont.
The following tenders for motor equipment for Toronto fire department have been awarded by Board of Control; pumping engine, Hugh Cameron and Company, representing Waterous Company, of Brantford, $10,500; hook-and-ladder truck, American La France Fire Engine Company, Elmira, N.Y., $8,775; two combination chemical engines and hose wagons, Seagrave and Company, $6,200 each; combined engine and hose wagon, American La France Company, $7,695; two combined engines and hose wagons, White Company, $7,674 each.

The following contracts have been awarded by the Board of Control for fire apparatus: (1) motor pumping engine, Waterous Engine Works Co., Brantford, Ont.; (2) motor hook and ladder truck, Seagrave & Co., Walkerville, Ont.; (3) combined hose and chemical engine motor trucks, 2 to Segrave & Co., Walkerville; 2 to White Engine Co., Cleveland, Ohio; and 1 to Am. LaFrance Fire Engine Co., Elmira, N.Y.

Miscellaneous

Carleton Place, Ont.
Tenders will be received by R. C. Desrochers, Secretary, Dominion Government Department of Public Works, until 4 p.m., September 15, for interior post office fittings, comprising screen, money order counter, table, desks, new floor in lobby, vestibule, etc. Plans and specifications are with J. F. Halpenny, Caretaker; carpentry, T. A. Hastings, Clerk of Works, Postal Station "F," Toronto, and at the Department, Ottawa. Specifications may be seen at office of MacLean Daily Reports, Limited, Toronto.

London, Ont.
In connection with the Egerton St. Baptist Church Club, gymnasium apparatus consisting of 1 reclining and 2 shower baths, set of carpet balls, basket balls, wrestling mat and reading room equipment is required. R. Mills, 963 Hasket St., is President.

North Battleford, Sask.
The Secretary of the Dominion Gov-

ernment, Department of Public Works, Ottawa, R. C. Desrochers, will receive tenders until 4 p.m., September 22, for interior customs house fittings, comprising counters, standing desks, parcel racks and vault fittings. Plans and specifications are at the office of Messrs. Stephenson & Evans, architects, North Battleford, W. T. Mollard, Clerk of Works, Regina, and at the Department, Ottawa. Specifications are at office of MacLean Daily Reports, Toronto.

Orillia, Ont.
The Secretary of the Dominion Government Department of Public Works, R. C. Desrochers, Ottawa, will receive tenders until 4 p.m., September 16, for interior post office fittings, consisting of screen, money order counter, parcel pigeon hole cases, vault fittings, table, cupboards, wardrobe, blackboards, marble work, standing desk, open table, etc. Plans and specifications are at the offices of W. H. Croker, architect, Orillia; Clerk of Works, Postal Station "F," Toronto, and at the Department, Ottawa. Specifications at the office of MacLean Daily Reports, Limited, Toronto.

Welland, Ont.
The contract for hotel fire escapes for John Cooper, 100 Ross street, has been awarded to the Aikenhead Architectural Metal Works, Toronto.

CONTRACTS AWARDED

Shelburne, Ont.
The Secretary of the Department of Public Works will receive tenders until 4 p.m., September 16, for interior post office fittings. Plans and specifications are in the office of Dr. J. A. McKenzie architect, Shelburne; T. A. Hastings, Clerk or Works, Postal Station "F," Toronto; and at the Department, Ottawa.

Grimsby, Ont.
The Berlin Interior Hardwood Company has been awarded the general contract for the supply of interior post office fittings for the Department of Public Works.

Business Notes

Athens, Ont.
The marble works owned by A. E. McLean & Company has been destroyed by fire. The loss on building and contents is reported to be about $3,000. There is some insurance.

Calgary, Alta.
The city's programme of municipal work planned for the present year to the extent of over a million dollars will be finished as originally intended. Work will be proceeded with as funds are available.

Castleton, Ont.
A loss of about $3,000 has been sustained by the Castleton Cheese Factory owing to the destruction of their plant by fire. Some insurance was carried.

Chilliwack, B.C.
Premises occupied by Jones & Scott, Ltd., W. H Chattles' woodworking shop, and T. B. Grant's blacksmith shop on Princess Ave., have been completely destroyed by fire.

Deep Brook, N.S.
The Colonial Arms Hotel has been destroyed and a loss of $40,000 has been sustained.

Fort George, B.C.
The Dominion Hotel, on 4th and Dominion streets, has been burned down with a loss of about $6,000.

Homer, Ont.
The "Mansion House" hotel and barn, the proprietor of which is David Kinghorn, Cornwall, has been destroyed by fire, involving a loss of about $12,000. The property was partially covered by insurance.

Kentville, N.S.
The factory of the Niagara Spray Co., Aberdeen Street, has been burned down, and building and contents totally destroyed with loss of $13,000, partly covered by insurance. The owner will rebuild.

Moncton, N.B.
Minto Hotel, Robinson Street, has been partly destroyed by fire. The loss, covered by insurance, is reported to be $1,500.

Newcastle, N.B.
The livery stable owned by Edward Dalton has been destroyed by fire.

New Westminster, B.C.
The Strand Hotel, owned by J. B. Wilson, 1612 Sixth Avenue, has been damaged by fire, involving a loss estimated at $20,000, partly covered by insurance. The hotel was on Eighth Avenue and Columbia Streets.

New Westminster, B.C.
The sawmill belonging to the Fernridge Lumber Company, which was destroyed by fire recently, is to be rebuilt. C. W. Tait, Columbia street, is the managing director.

Ottawa, Ont.
The stores and residences, the property of R. T. Kaminsky, 57 William street, have been damaged by fire, and a loss of about $6,000 sustained. Structural repairs will be made shortly.

Stores and residences on Nicholas St. belonging to Mrs. M. O'Leary were destroyed by fire, involving a loss of $7,000.

Port Moody, B.C.
The Canadian Pacific Lumber Co.'s plant has been burned down, involving a loss estimated at $40,000.

Renfrew, Ont.
The capital of the Renfrew Machinery Co., Ltd., has been increased to $1,000,000.

Revelstoke, B.C.
The Bear Creek Hotel, the proprietors of which are J. B. Cressman and Miles Custer, has been destroyed by fire, involving a loss of $3,500. The amount of insurance is said to be $1,500.

Vancouver, B.C.
The Sash and Door Factory of the Sunset Sash and Door Co., 724 Broadway W., has been destroyed by fire, involving a loss of $8,000.

Winnipeg, Man.
W. R. Hamilton, 32 Canada Life Building, contemplates the erection of residences.

About $6,000 damage is reported to be sustained to building and machinery in destruction by fire of a laundry, property of Hospital Board of which Geo. Stoker is Secretary.

Deer Lodge Security Company, 202 Sterling Bank Building, contemplates forming a Building Company in 1915.

St. Thomas, Ont.
The stave mill owned by Sutherland-Innis Company on First Avenue and Wellington Street, has been totally destroyed by fire. The loss is covered by insurance.

Vancouver, B.C.
The Sunset Sash & Door Company's plant on Broadway has been destroyed by fire. The loss, which is estimated at $10,000, is partly covered by insurance.

New Companies

The Victor Amusement Company, Limited, has been incorporated with a capital of $40,000. Geo. L. Jackson, 87 Wellington Street, is interested.

McKenna, Limited, has been incorporated with a capital of $50,000, with power to conduct a general nursery business, erect green houses, etc. Mr. Jas. McKenna, 700 St. Catharine Street West, is interested.

The Morrisburg and Ottawa Construction Company, Limited, has been incorporated with a capital of $40,000.

Sault St. Marie, Ont.

The Algoma Timber and Lumber Co. has been incorporated with a capital of $120,000.

The B. C. Steel Works has recently been incorporated with registered office at Vancouver. The company has acquired five acres of land and 300 feet of water frontage at Bridgeport, Lulu Island.

The Kildonan Hygenic Derrick Co., Ltd., is incorporated with a capital of $100,000.

Fibred-Asphalt Paving Co., Ltd., is incorporated for the manufacture and sale of fibred asphalt, also as a general contracting and construction company. The capital of the company is $500,000. The provisional directors are: Melville Thorold Matthews; Robert C. LeVescoate; Vernon J. Callen; and Stuart A. Murray.

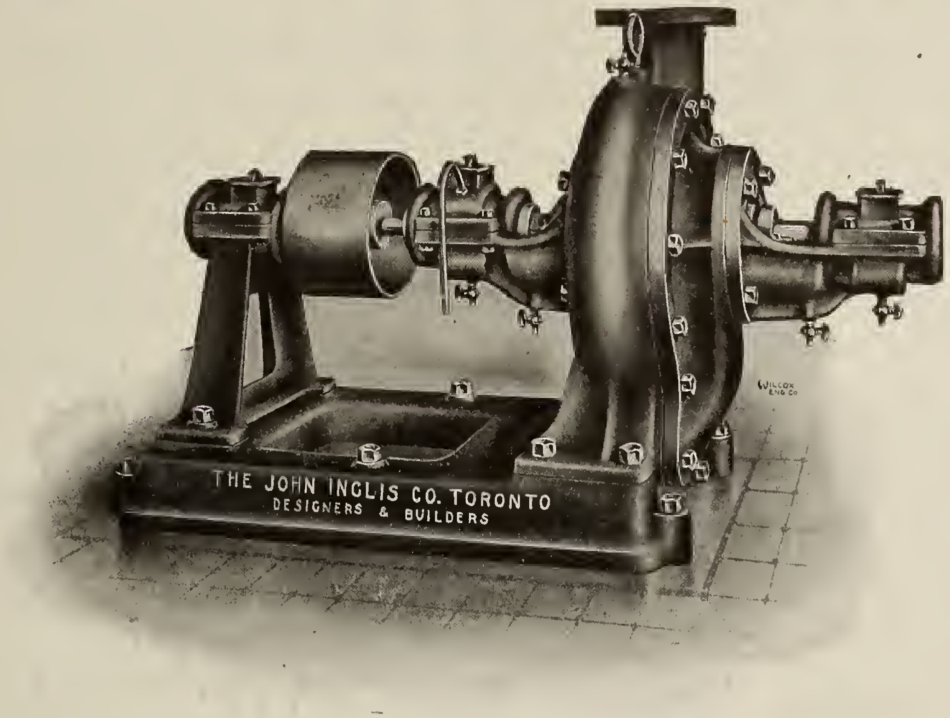
The Decarie Boiler and Incinerator Co., Ltd., has been incorporated with head office at Vancouver, B.C., for the manufacture of boilers and incinerators. The capital of the company is $20,000.

The Burrard Inlet Gravel & Dredging Company, Limited, has been incorporated with a capital of $10,000, and head office at Vancouver. The new concern will carry on the business of general contractors for the erection of buildings, wharves, dry-docks, etc.

The A. B. Cushing Lumber Company, (Vancouver) Limited, was recently incorporated with a capital of $20,000. The head office is at Vancouver.

Power & Son,
Architects and Building Surveyors
Merchants Bank Chambers,
Kingston, Canada

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Tenders and For Sale Department

Tenders Wanted

Tenders will be received by the undersigned until 6 p.m. **Saturday, September 19, 1914**, for the construction of a sewer on Main Street, Mitchell, Ont. Estimated cost $800.

The lowest or any tender not necessarily accepted.

Plans and specifications can be obtained from the Town Clerk or Town Engineer, Mr. J. Roger.

WM. RYAN,
Town Clerk.

37

Vancouver Civic Centre 1914

The Committee appointed by His Worship Mayor Baxter invite competitive designs for the development of the proposed Civic Centre. Premiums amounting to $500 and $250 will be awarded to the designs placed first and second respectively. The award will be made by independent experts whose decision shall be final. All designs must be delivered not later than November 30th, 1914. Programme of competition and plans may be obtained from the Secretary, Vancouver Civic Centre Committee, care Vancouver Board of Trade, 543 Hastings Street West, Vancouver, B.C. 36-39

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, September 25th, 1914

For All Trades

Two New School Buildings for Annexes

at

Essex Street and Huron Street Schools

Also for

Plumbing, Drainage and Electrical Work Sundry Schools

Cabinet Work

Sale of Old House

Specifications may he seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

W. C. WILKINCON,
Secretary-Treasurer.

J. W. JACKSON,
Chairman of Committee.

37

Tenders for Bridge

Contractors desirous of tendering on a concrete bridge costing approximately One Million Two Hundred and Fifty Thousand ($1,250,000) Dollars, please communicate with the undersigned.

JAMES, LOUDON AND HERTZBERG,
Engineers,
205 St. James Chambers, Toronto, Ont.

37

Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, September 29th, 1914**, for the construction of the following sewers, viz.:—

Balfour Ave., Barrington Ave. to Dawes Road.

Barrington Avenue, Danforth Avenue to north city limit.

Coleman Avenue, Barrington Avenue to east city limit.

Crown Park Rd., McLean Ave. to west end.

Fairmount Cres., Cannon Ave. to Glenmore Rd.

French Ave., Willard Ave. to Windermere Ave.

Jane Street, Bloor Street to Annette Street.

Nelles Ave., Armadale Ave. to Jane Street.

Oakcrest Ave., 93 ft. 2 in. east Sherwood Ave. to Westlake Avenue.

Weatherell Ave., Armadale Ave. to Jane Street.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tenders the names of two sureties approved of by the City Treasurer, or in lieu of said sureties the bond of a Guarantee Company approved of as aforesaid. Conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, September 9th, 1914. 37

Agents Wanted

Large firm making diaphragm pumps with improved patent valves wants to secure agents in Canada. Pumps made in all capacities up to 14,000 gallons per hour. Workable by hand or mechanical power. Address Box 70, Contract Record & Engineering Review, Toronto. 52-37

Late News Items

Athabasca, Alta.

The following contracts have been awarded in connection with filter plant and reservoir:—Construction of reinforced concrete reservoir and concrete work on filter plant, Jamieson Construction Co., Edmonton, $2,248; 500 lbs. of cement at $1,350, C. A. Dallas, Athabasca; 10-ton steel reinforcing at $660, Canadian Equipment and Supply Company, Edmonton.

Berlin, Ont.

Merchants Bank of Canada, King St., is receiving tenders for general contract on the bank and office building to be erected on King and Queen streets. Building will be three storeys, Ohio sandstone front.

Goderich, Ont.

Ratepayers have passed by-law guaranteeing bonds of $25,000 for erection of $50,000 addition of third floor to present furniture factory, owned by J. E. Baechler, North street.

Hull, Que.

City Council is contemplating the building of a firehall in Wrightville district. Mr. Tessier is Fire Chief.

Kingsville, Ont.

Ecethermal Stove Company, Warren, Ohio (F. S. Thomas) will purchase equipment for manufacturing stoves to the amount of $15,000.

Nanaimo, B.C.

By-law for public library is to be submitted to ratepayers by Municipal Council. Carnegie Fund will grant $50,000. Mr. Shaw is the Mayor.

Newcastle, N.B.

Plans are to be drawn at once, and work will start early next spring, on $30,000 hospital, stone and brick construction, for Miramichi Hospital Board.

Ottawa, Ont.

The contract for stores on George St., two storeys, solid brick construction, for Geo. Lavelle and Jos. Reopelle, 225 Rideau street, has been awarded to Ernest Emard, 224½ Church street. Estimated cost, $10,000.

Quebec, Que.

The Ross Rifle Factory is to be enlarged considerably. Capacity is now 200 rifles per day.

Toronto, Ont.

A permit has been issued for erection of $100,000 factory on West Lodge Ave., for Gutta Percha Rubber Company. Building will be three storeys, steel and brick construction. Work not to be started for some time. Sproatt & Rolph, 36 North street, are the architects.

Tenders will be received by Board of Control until noon, September 29, for construction of a number of sewers.

Winnipeg, Man.

The contract for supplying five thousand feet of 10-in. water pipe has been awarded to Canada Iron Corporation, Limited, Montreal, at $35.50 per ton, for Board of Control.

The contract to supply 1,500,000 to 2,000,000 ft. of b.m. lumber has been awarded by Board of Control to Thos. D. Robinson & Son, Limited, Winnipeg.

Walkerville, Ont.

Tenders will be received by Stahl, Kinsey & Chapman, Strathcona Building, architects, until September 19, for stores and flats on Lincoln Road, estimated cost $19,000, for R. A. Holland. Building will be two storeys, hollow tile, terra cotta and pressed brick construction.

One Municipality Saved $92,000

By advertising their tenders in the " Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

The "Contract Record" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886
Contract Record and Engineering Review

220 King Street West, Toronto

MADE IN CANADA

"Sirocco" Spray Head

It's the design and operation of the spray heads that's responsible for the efficiency or inefficiency of an air conditioning system.

"Sirocco"
TRADE MARK.

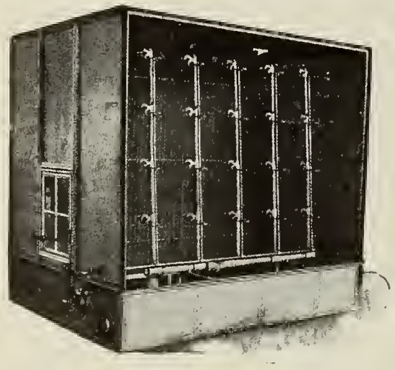
Purifiers, Coolers and Humidifiers

are equipped with spray heads which were designed to overcome the usual "clogging up" trouble. All heads can be flushed simultaneously by slightly turning a three-way cock located on the **outside** of the Purifier.

All heads are adjustable as to density of spray and can be permanently set at any desired point by means of a lock nut.

All heads are made of brass and accurately machined to template.

No packing is used.



Purifier Complete

Architects, Engineers and Contractors are invited to ask us for any information whatsoever regarding the design, construction, operation and application of Sirocco purifiers, Coolers and Humidifiers.

Write for Bulletin No. 2301.

CANADIAN Sirocco COMPANY
LIMITED
WINDSOR. ONTARIO.

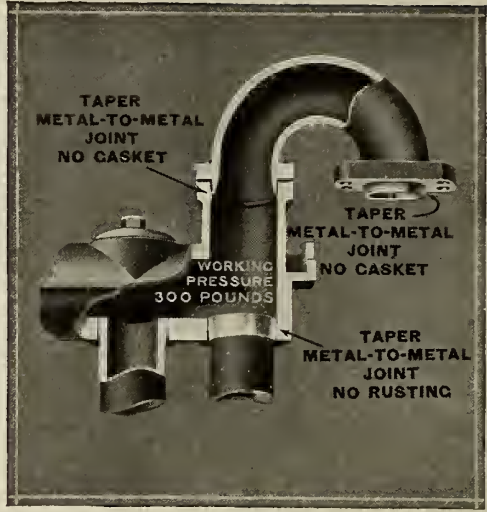
Sales Engineers:

CLARK T. MORSE
301 McGill Bldg., Montreal

E. C. POWERS
43 Victoria St., Toronto

W. P. EDDY
301 Tribune Bldg., Winnipeg

S. S. CLARKE
605 - 2nd St., Calgary


TAPER METAL-TO-METAL JOINT NO GASKET
TAPER METAL-TO-METAL JOINT NO GASKET
WORKING PRESSURE 300 POUNDS
TAPER METAL-TO-METAL JOINT NO RUSTING

Five Minutes Arithmetic Saves them $5000 a Year

A Massachusetts manufacturer of textiles was wasting about 20 per cent. of the heat of the coal up the chimney. He figured out the saving which a fuel economizer would make and installed a

Sturtevant
(REG. CAN. PAT. OFF.)

Fuel Economizer

He now reclaims approximately half of this waste heat. This is a 9 per cent. saving on the coal bill or $5,000 annually. (Name on application).

The money saving features of the Sturtevant all hinge on its **mechanical and thermal correctness.** Here are the details.

Sturtevant Economizers have **staggered pipes**—no straight paths between lines of pipes through which the gases rush direct to the stack. In fact the hot gases must wind in and out from pipe to pipe. They completely encircle each pipe, thus transmitting more of the heat to the feed water than if the pipes were in straight rows. The staggered feature is patented.

A second feature are the scrapers—absolutely non-sticking—therefore maximum thermal efficiency all the time. Again, they cost nothing for repairs. The first cost is the only cost.

The Sturtevant hasn't a gasket throughout—all metal-to-metal joints that have proved non-leakable in service. Perhaps you have not realized that you waste 15 or 25 per cent. of the heat of your coal every single day—that every day you procrastinate costs you from $10 to $25. Invest in a Sturtevant Fuel Economizer, and it will pay a handsome dividend. Send for bulletins on Sturtevant Fuel Economizers and Mechanical Draft.

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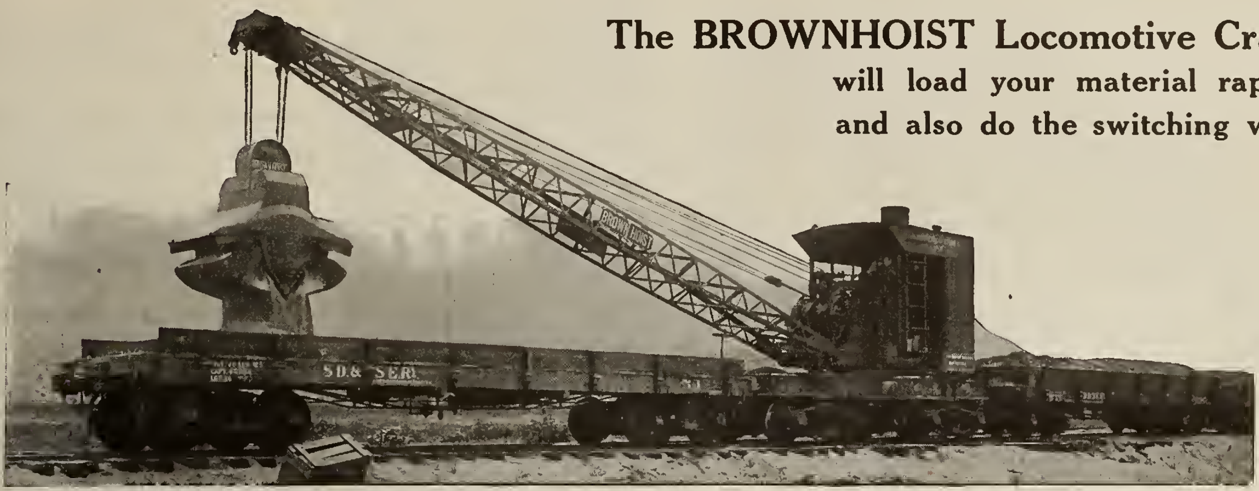
The BROWNHOIST Locomotive Crane
will load your material rapidly
and also do the switching work



15-ton Brownhoist Locomotive Crane with Brownhoist Grab Bucket used by the Independent Stone Co., San Diego, Calif.

This crane with the Brownhoist patented grab bucket, handles ore, coal, crushed stone, sand, gravel, etc., 60 to 120 tons per hour. And one man operates the crane. Figure what a saving this would mean in your handling costs. And when you use a Brownhoist crane you are not continually troubled with breakdowns. Ask the owners—they will tell you.

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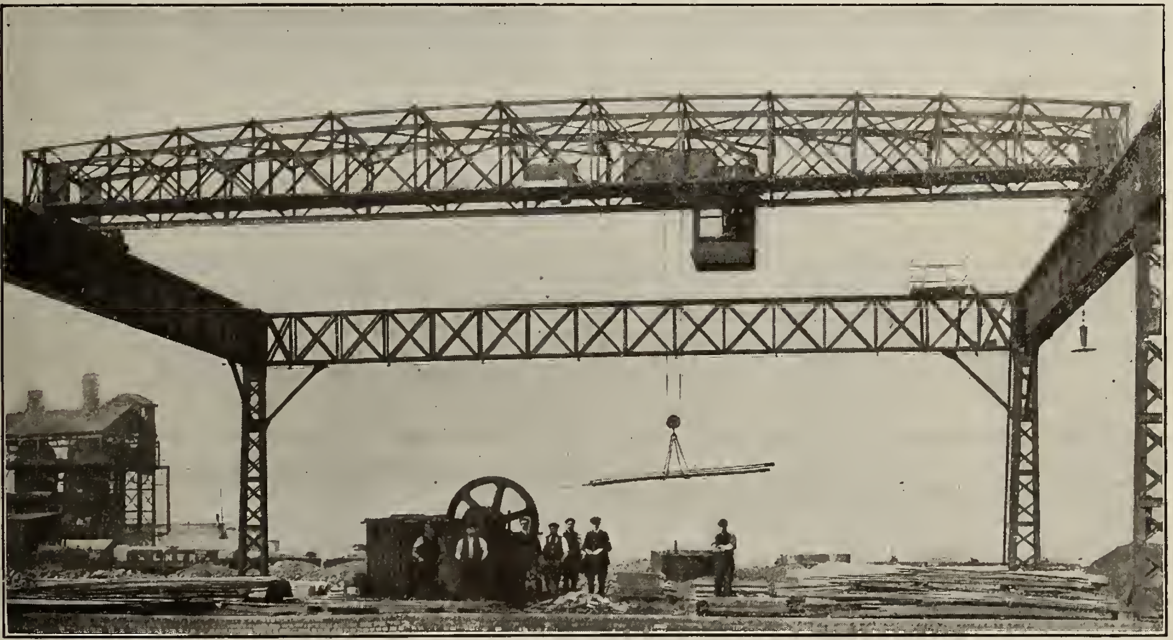

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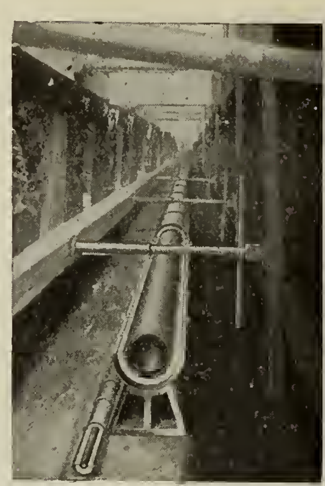

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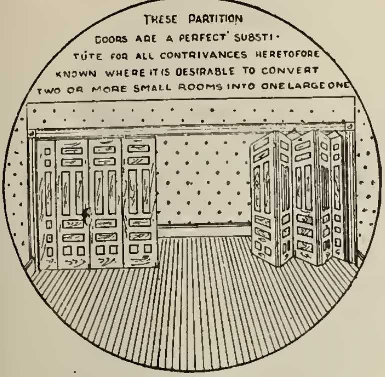
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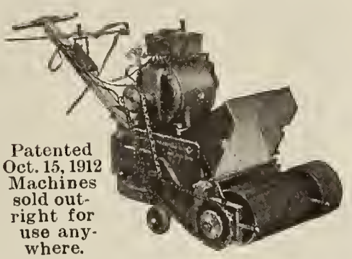

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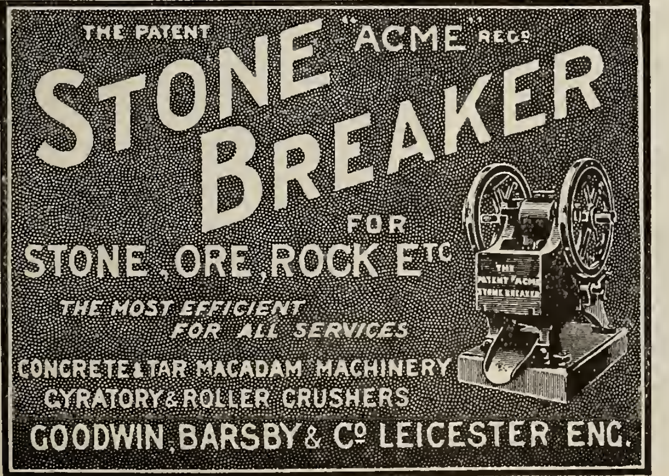
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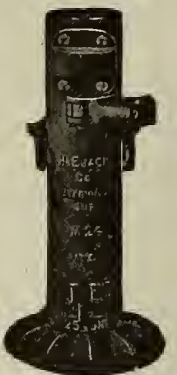

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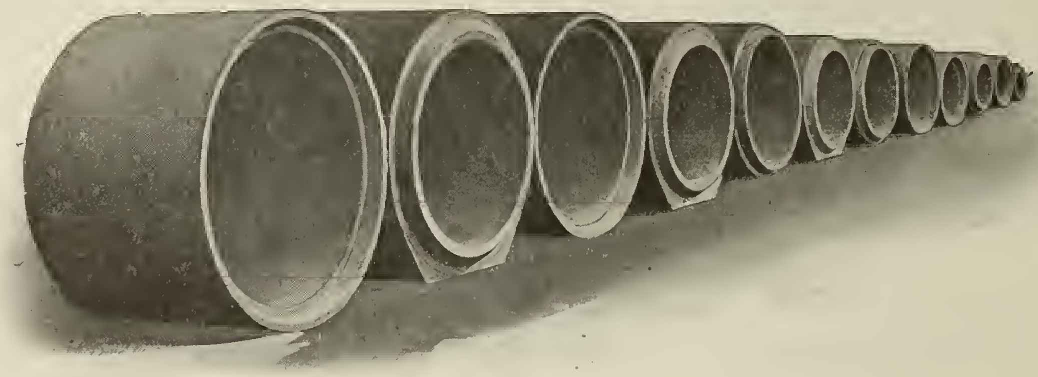

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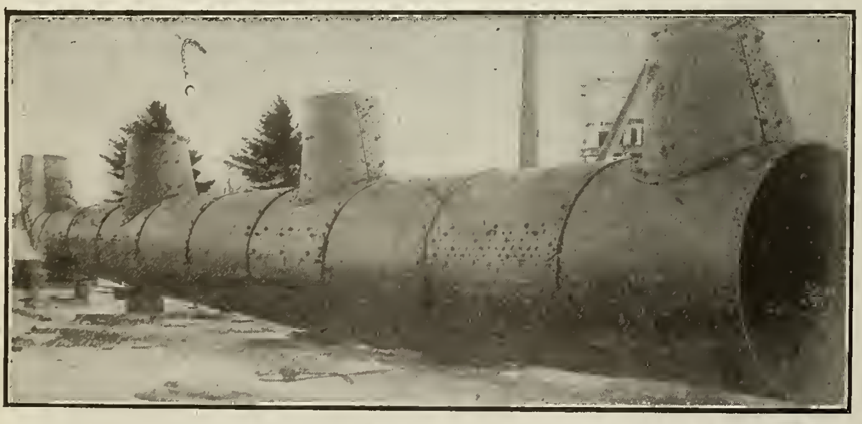

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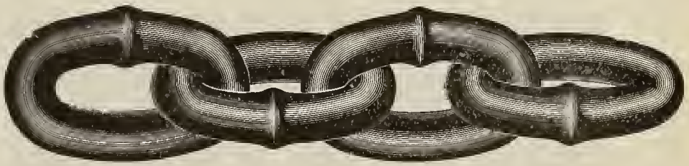

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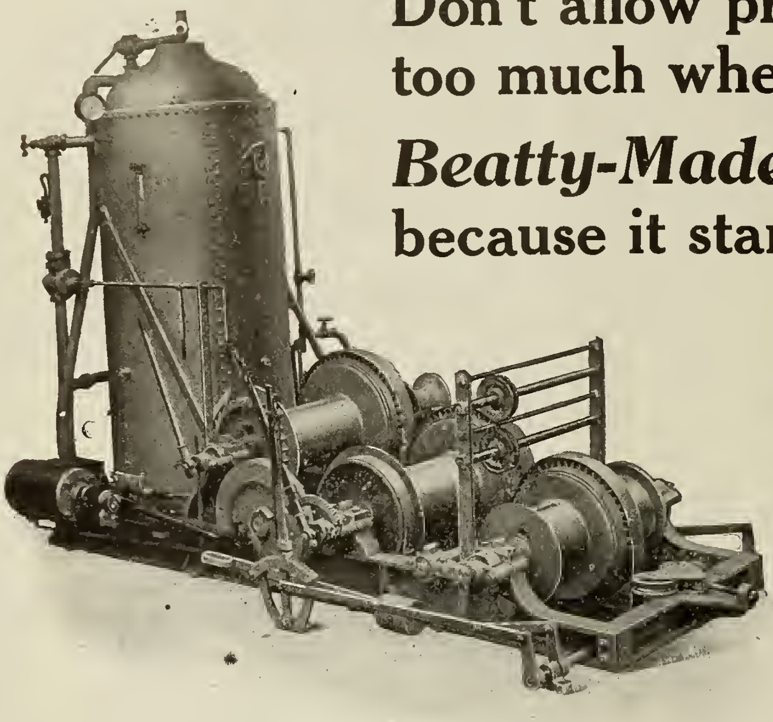

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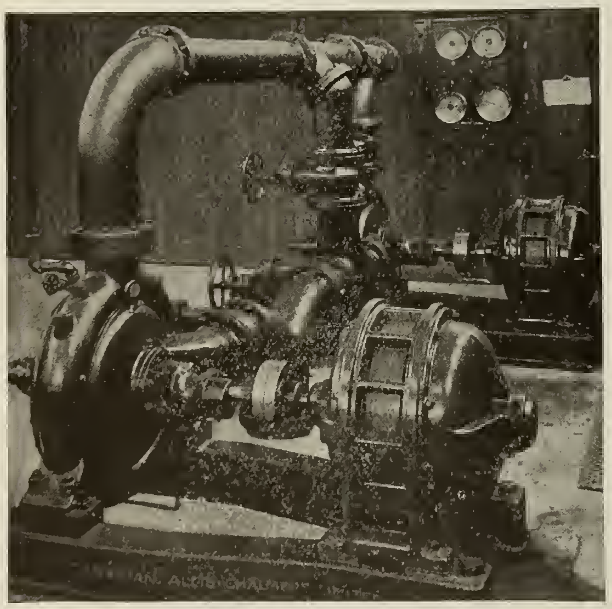

In the illustration are the two single stage turbine pumps of the town of St. Boniface, Man., arranged to operate in series capacity 1,040 gals. per min. against 320 ft. or in parallel 2080 gals. per min. against 160 ft.

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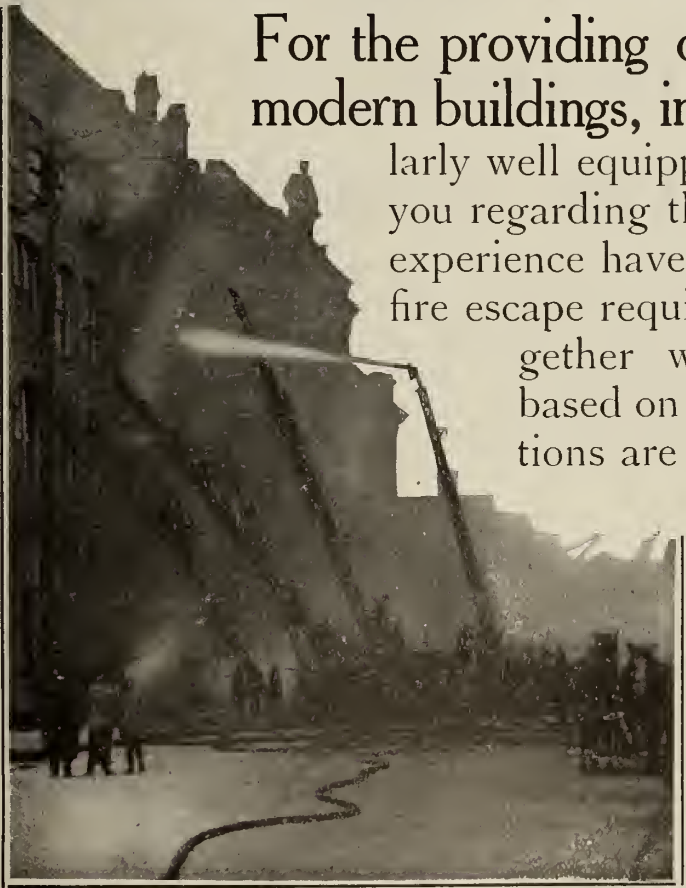

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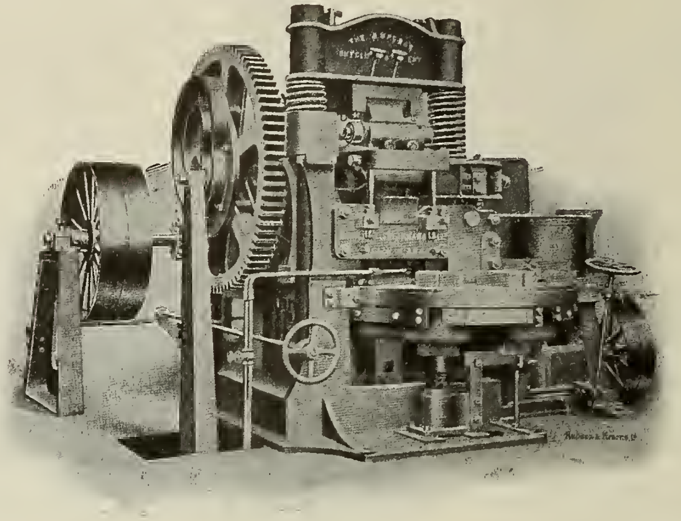

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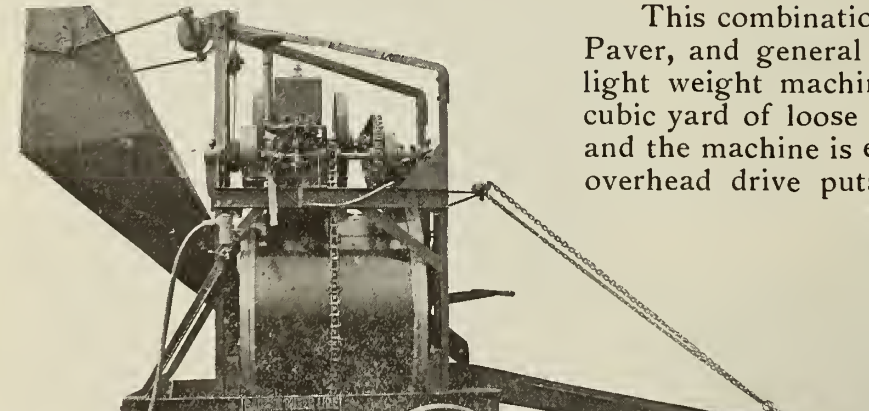
Street Paver and Mixer



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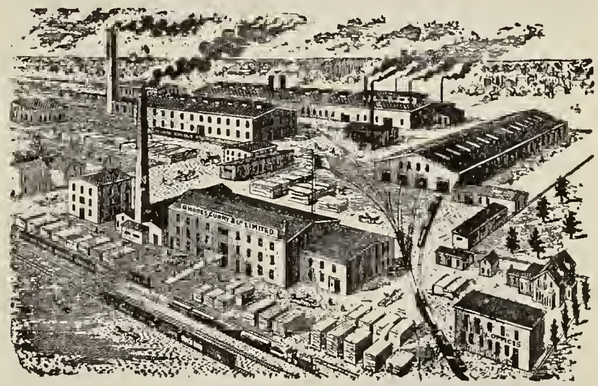

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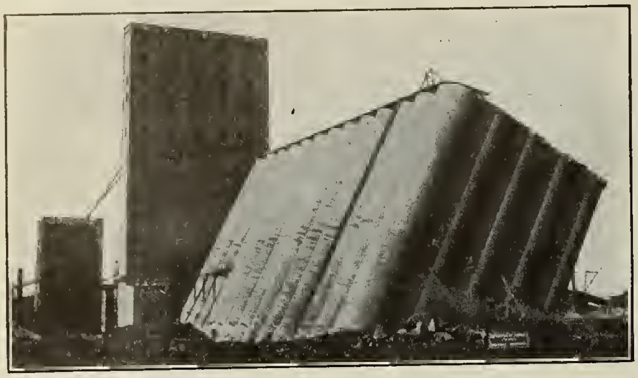

NOTICE

The building in the illustration, built of concrete, was righted to its proper position without damage to structure.

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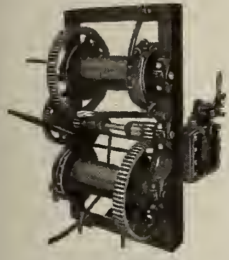
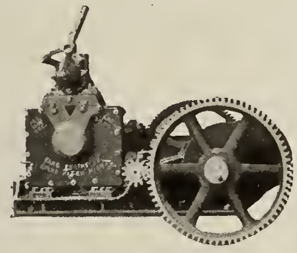


Motor Crab

Write for catalog and prices

Dake
Engine Co.
Grand Haven,
Mich.



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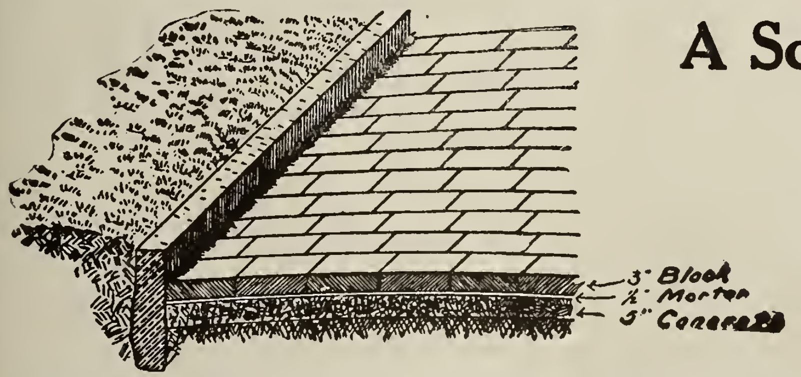

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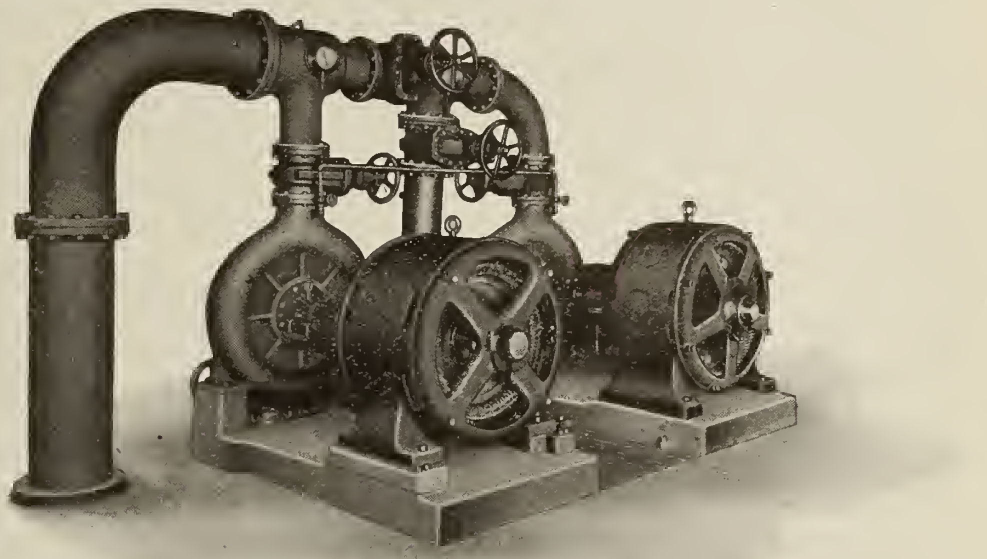

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Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $30; sand-lime brick, $8.10, King Edward Siding; $7 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Quotations withheld.

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge

Steel channels and beams, angles and plates—$4.

$2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 73c per gal. of 9 lbs.

Raw linseed oil—in bbls., 70c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 67c.

MONTREAL PRICES

CEMENT, LIME AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal. Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13c basis; African hemp, 13c; sisal rope 10½c basis. Boiled linseed oil—in barrels, 60c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car-load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, delivered, $13 per cord.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16,

(Continued on page 90)

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Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

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7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it.
9—It has over 99 per cent. bitumen. Purest on the market—therefore free from deleterious matter.
10—It is so constituted that it will not be injured by the heat necessarily applied to melt it for paving operation.

Samples, prices, analyses, etc., on request

The Asphalt and Supply Co., Limited

Sole Canadian Agents for the Mexican Eagle Oil Co. Limited
103-107 Board of Trade Building :: MONTREAL

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from p. .)

16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $8.85 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.15 to $3.65.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.15 to $3.65 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

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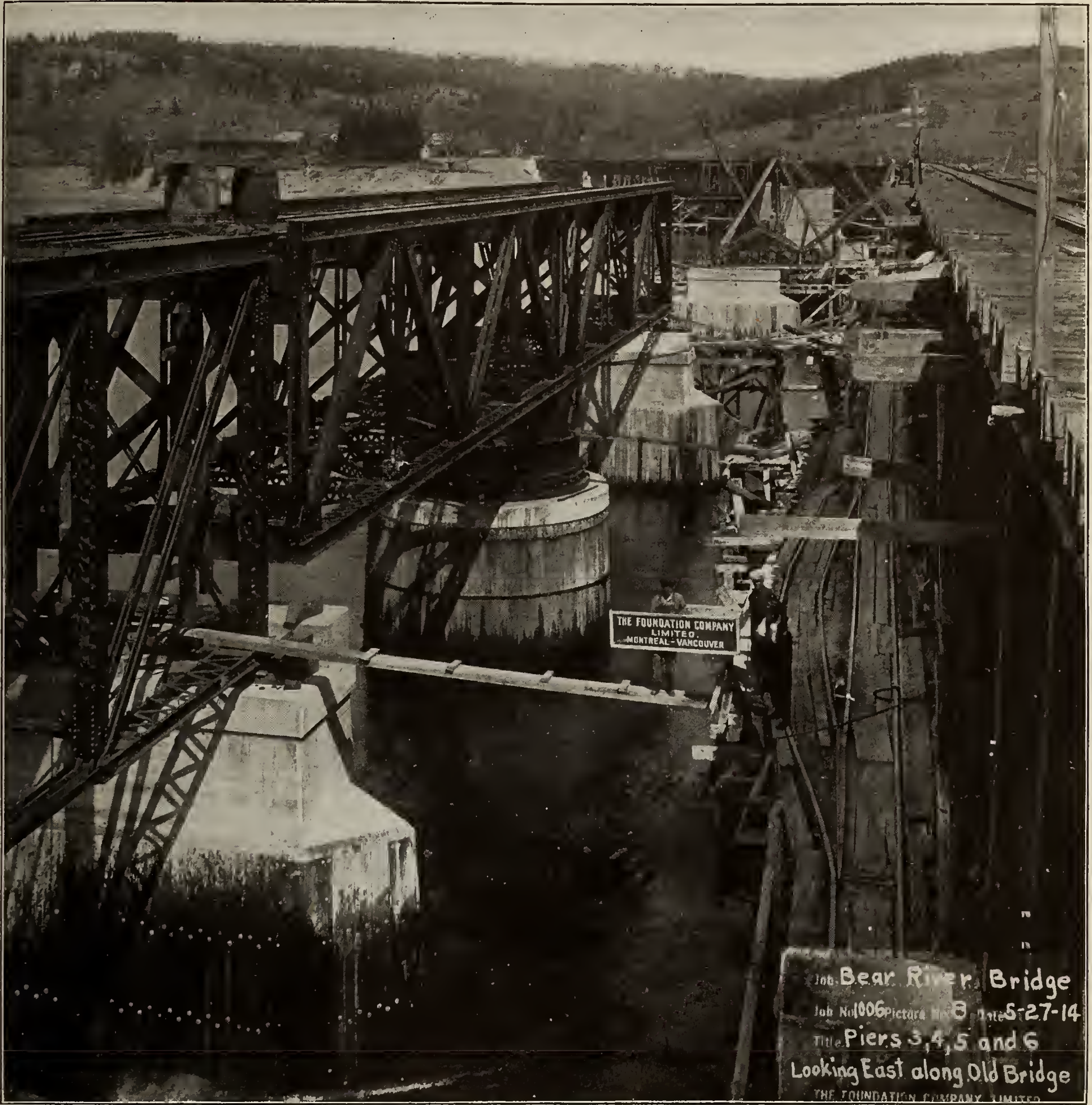
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Job Bear River Bridge
Job No 1006 Picture No 8 Date 5-27-14
Title Piers 3,4,5 and 6
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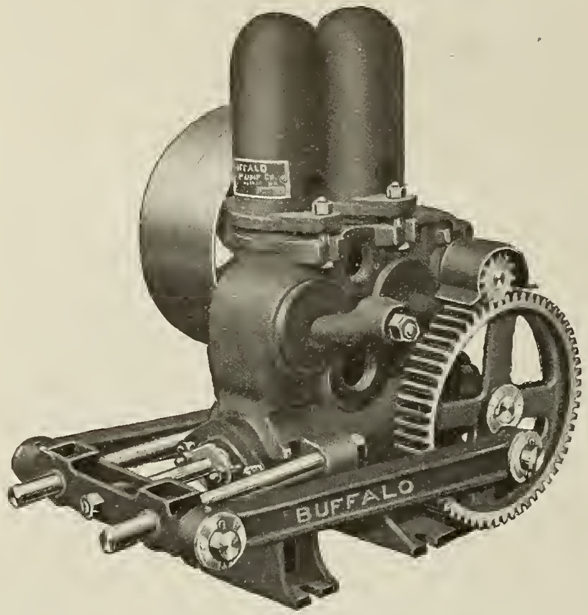

Fig. 401

The power pump illustrated is a distinct departure from the older competing designs now on the market. It will be noted that both the suction and discharge openings are above the cylinder. Because the suction valves are above the water piston the water contained cannot leak out when the pump is stopped. In other words the pump **always stays primed** and will immediately pick up its suction after a long period of rest because the cup leathers will not have dried out. This design is by far the best for handling water through long suction pipes and for the greatest convenience of operation. Two large air chambers are provided directly above the discharge valves where they are doubly effective and as they are easily detached the discharge valves are easily accessible. The suction valves are reached through two cover plates both of which may be taken off by removing one nut.

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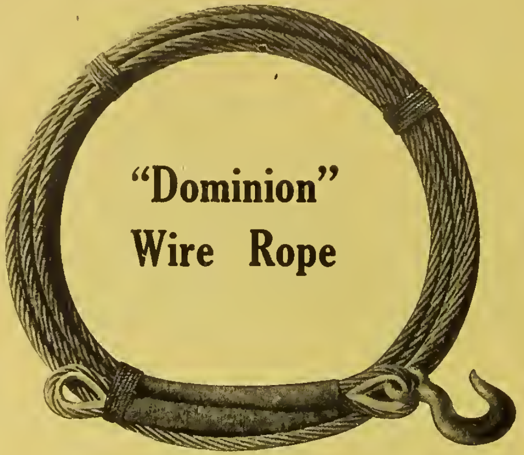

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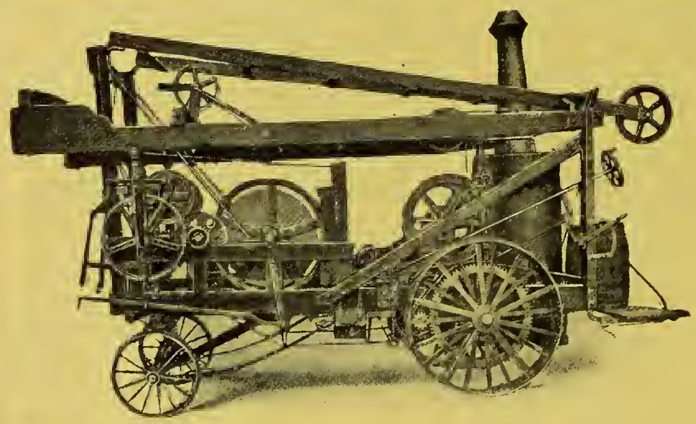

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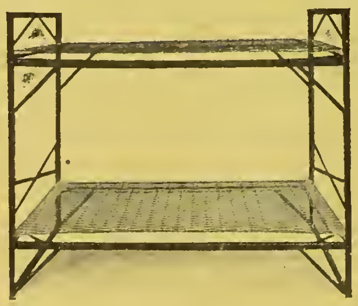

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Vol. 28 Toronto, September 23, 1914 No. 38

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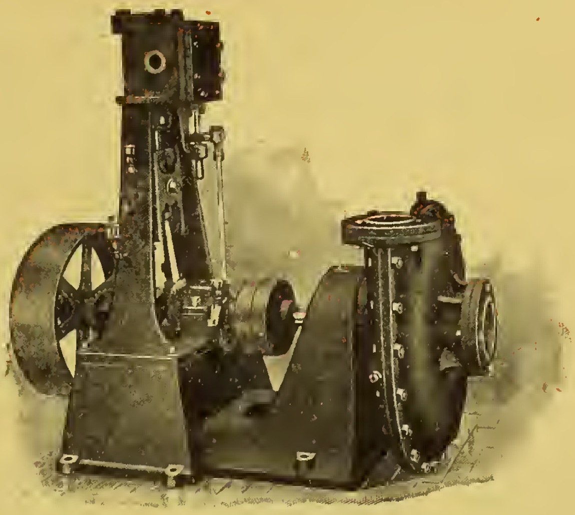

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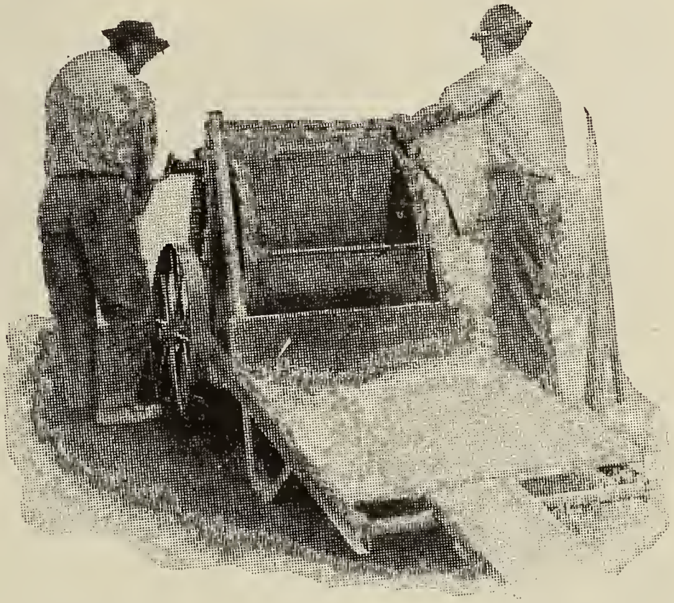

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Badger Concrete Mixer Co.
Canadian Allis-Chalmers, Ltd.
Goold, Shapley & Muir Co.
Hopkins & Co., F. H.
Jaeger Machine Company
Lecky & Collis
London Concrete Machinery Co.
Marsh Capron Company
Mills Bros.
Municipal Engineering & Contracting Co.
Mussens Limited
Rock & Power Machinery
Sutcliffe, Speakman & Co.

Contractors
Anglins Limited
Dietrich Limited
Eastern Pipe Construction Co.
Foundation Company, Limited
Wells & Gray

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American Hoist & Derrick Co.
Austin Drainage Excavator Company, F. C.
Badger Concrete Mixer Co.
Beatty & Sons, M.
Browning Company
Canadian Allis-Chalmers, Ltd.
Can. Billings & Spencer
Canadian Locomotive Company
Canadian Brakeshoe Co., Ltd.
Central Locomotive & Car Works
Dake Engine Co.
Dominion Lime Company
General Car & Mach. Works
Goodwin, Barsby & Co.
Hamilton Mfg. Co., Wm.
Hepburn & Co., J. T.
Honig & Mock
Hopkins & Co., F. H.
Jaeger Machine Company
Jenckes Machine Company
Lecky & Collis
Marsh & Henthorn
McKinnon Chain Co.
Mills Bros.
Morris Machine Works
Municipal Engineering & Contracting Co.
Montreal Locomotive Works
Mussens Limited
Radigan Company, John
Railway Contractors Supply Co.
Royce Limited
Schell Foundry & Machine Co.
Stinson-Reeb Builders' Supply Co.
Sudbury Construction & Machinery Co.
Tiffin Wagon Works

Controlling Altitude Valves
Golden Anderson Valve Co.

Conduits
Can. H. W. Johns-Manville Co.
Conduits Co., Limited
Orpen Conduit Co., Ltd.
Ric-wiL Underground Pipe Covering Company

Contractors' Flare Lights
Sudbury Construction & Machinery Company

Conveying Machinery
Goodwin, Barsby & Co.
Sturtevant Co. of Can., Ltd., B. F.
Sutcliffe, Speakman & Co.

Core Drills
Can. Ingersoll-Rand Co., Ltd.

Corrugated Iron
Can. H. W. Johns-Manville Co.
Metallic Roofing Co.
Pedlar People Limited

Crank Shafts
Canadian Billings & Spencer

Cranes, Travelling and Locomotive
American Hoist & Derrick Co.
Beatty & Sons, M.
Browning Company
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert
Northern Crane Works
Rock & Power Machinery, Ltd.
Roelofson Elevator Works
Royce Limited

Creosote Stains
Cabot, Inc., Samuel

Crushed Stone and Granite
Hagersville Contracting Co.
Ontario Lime Co., Ltd.
Rogers Supply Company
Smyth & Ryan

Crushers (Stone and Rock)
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Goodwin, Barsby & Co.
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Mussens Limited
Rock & Power Machinery
Sutcliffe, Speakman & Co.

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Pedlar People

Cupolas (Foundry)
Northern Crane Works

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Mannesmann Tube Company

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Aikenhead Hardware Limited
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Hepburn, John T.

Dredges
Beatty & Sons, M.
Browning Company
Morris Machine Works

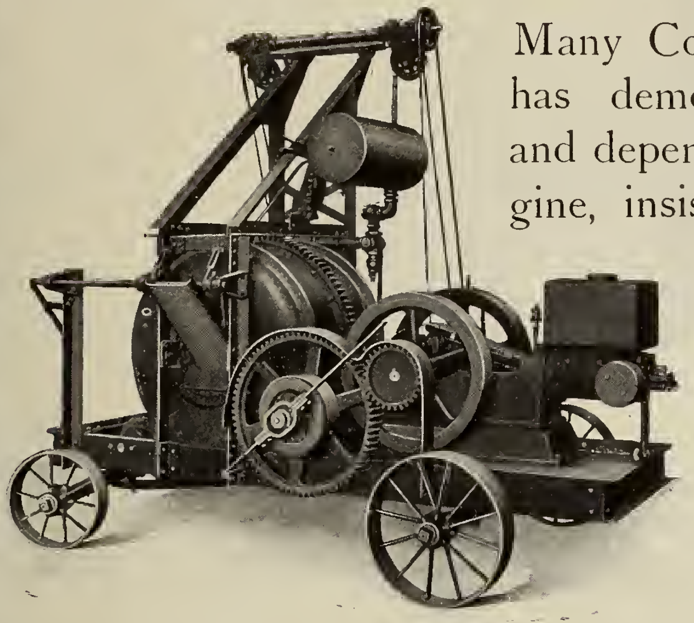
Drills
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis

Drill Steel Sharpeners
Canadian Ingersoll-Rand Co.

(Continued on page 12)

Take a Good Look at this Gasoline Driven

M-C Rail Track Mixer



Many Contractors, since the automobile has demonstrated the positive, reliable and dependable power of the gasoline engine, insist on gasoline-driven mixers.

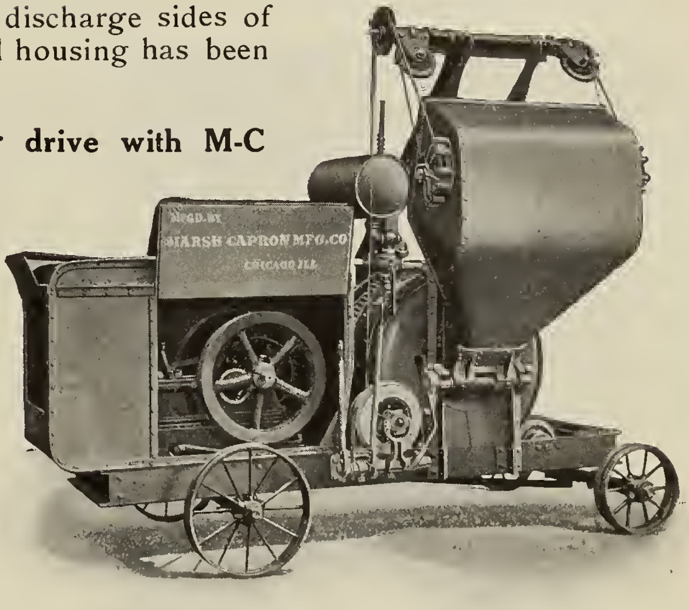
This demand is met by the

M-C RAIL TRACK MIXER

mounted on trucks with Elevating Side Loader and Automatic Water Measuring Tank; operated by Gasoline Engine in Steel House.

The two views here show the charge and discharge sides of the machine. In the upper view the steel housing has been removed to show the engine.

A feature of this outfit is the **spur gear drive with M-C Friction Clutch** so engine may be started without turning mixer.



This mixer is built in **five sizes,** with capacities of ¼, ⅓, ½, ¾ and 1 cu. yd. of concrete per batch.

The **gasoline engines** are 5, 6, 8 and 10 H.P.; hopper cooled, gasoline supply carried in base of engine.

The mixer illustrated is one of our most popular outfits. **It is highly recommended by us and carries our absolute guarantee.**

CANADIAN FAIRBANKS-MORSE CO., Ltd.

Montreal St. John Ottawa Toronto Victoria Vancouver Hamilton

Manufactured by

Marsh-Capron Mfg. Company
465 Old Colony Bldg., CHICAGO

Look at the Material the Austin Handles

Austin Trench Excavator digging for the City of Calgary, Alberta, Canada

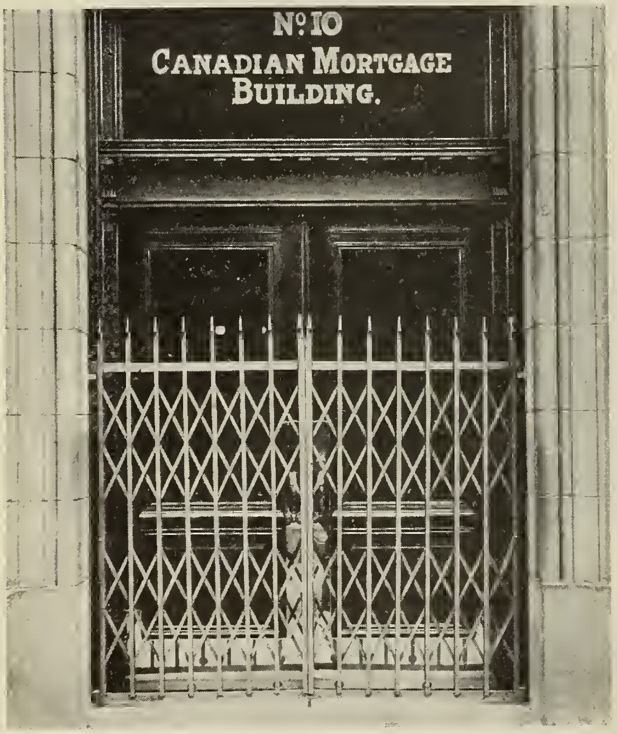
You know about how the cost for hand labor in this kind of material would mount up. Most of those are "1-man" boulders the AUSTIN TRENCHING MACHINE is throwing out of the trench along with other material. The machine is built to stand the wear.

You are not always sure of easy earth excavation on your sewer or other trenching jobs. Why not buy a machine that stands up under heavy work? Contractors who have used Austin Trenching Machines for years will tell you the kind of service they give. You can dig a wide or narrow trench with the AUSTIN. You are not limited to a single width for each machine. Austin Trenching Machine No. 10, a popular type, will dig a trench from 24 inches to 6 feet wide, and any depth up to 25 feet.

Replace that big gang of laborers with two men and an Austin Trenching Machine. See the difference it will make in the speed of your work—and in your expense.

Write to our Canadian Representatives—the one nearest you.
Lecky & Collis, Limited, 49 Beaver Hall Hill, Montreal; 43 Scott St., Toronto, and P. O. Box 611, Napanee, Ontario.
Canadian Equipment & Supply Co., Calgary and Edmonton. E. G. Cullen, 418 Pacific Bldg., Vancouver
Dominion Equipment & Supply Co., Winnipeg, Manitoba

F. C. AUSTIN DRAINAGE EXCAVATOR CO. Railway Exchange, CHICAGO, U. S. A.
Agents Wanted in Open Territory



Steel Collapsible Gates

We make a specialty of all types of Collapsible Gates for Main Entrances, Store Fronts, Elevator Openings, etc.

ILLUSTRATIONS AND PRICES GLADLY GIVEN

Aikenhead Architectural Metal Works

364-370 Richmond Street W., Toronto, Ont.

For **Permanent** Lines :

CAST IRON PIPE

for

Water and Gas Supply, Fire Protection, Road Culverts, etc.

30″ Intake, floated to position before lowering

United States Cast Iron Pipe & Foundry Co.

General Offices :—BURLINGTON, NEW JERSEY

Sales Offices :—Philadelphia, Chicago, Buffalo, Portland, (Ore.,) New York, Chattanooga, Pittsburgh, St. Louis, San Francisco

Simplicity and Strength

These are the things that a Contractor demands of Dump Cars and the only way to get them is to buy

Bechtel Cars

Our Cars are strongly built and braced throughout and nothing to get out of order on them.

OUR LINE

- Side Dump Cars
- All-round Dump Cars
- Bottom Dump Cars
- Winding Drums
- Portable Track and Switches
- Switch Points, Frogs and Throws
- Brick and Tile Machinery
- Brick and Tile Driers

Favor us with your inquiries.

Bechtels Limited **Waterloo, Ontario**

Head Office and Works

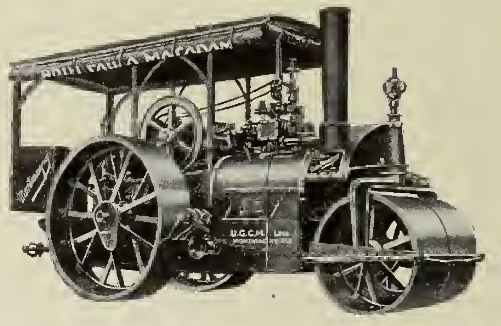
"Montmagny" Modern Road Builders

WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue



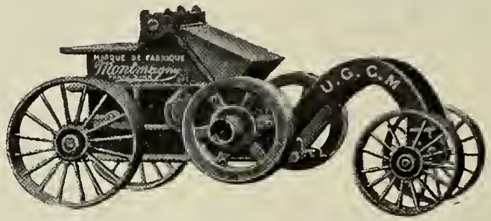
" Montmagny " Steam Road Roller.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

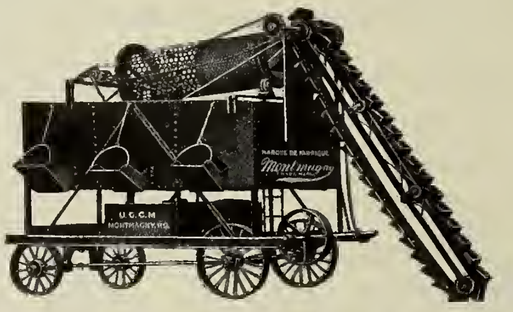
A great feature "Power Steering"



" Montmagny " Stone Crushers.

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.



" Montmagny " Portable Steel Bin.

Steel Bin

The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

Quebec MONTMAGNY, P.Q., Can. Montreal

WARREN
CAST IRON PIPE

"Quality First"

Backed by 58 Years' Experience

The experience and prestige gained in fifty-eight years' of cast iron pipe making is back of every length of **Warren Pipe.**

No matter what your requirements are—no matter how the specifications read, standard or special, we have the equipment to give you **what** you want, **when** you want it. A large stock, always on hand, guarantees prompt shipment, in any season.

Ask us to quote on your next order—any size, 3" to 60" diameter, bell and spigot or flange—also special fittings, and castings of all kinds.

Warren Foundry & Machine Co.

Sales Office—**11 Broadway, New York**
Shops at **Phillipsburg, N. J.**

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Drop Forgings
- Canadian Billings & Spencer, Ltd.

Dump Cars, Wheels, etc.
- Bechtels Limited
- Manitoba Bridge & Iron Works
- Schell Foundry & Machine Co.
- Sheldons Limited

Dump Carts and Wagons
- Deere Plow Co., John
- McNally & Co., Wm.
- Troy Wagon Works

Drying Apparatus
- Sturtevant Co. of Can., Ltd., B. F.

Electric Fans
- Sturtevant Co. of Can., Ltd., B. F.

Electric Air Rock Drills
- Canadian Ingersoll-Rand Co.

Electric Impulse Clocks
- Gent & Company

Electric Steel Castings
- Electric Steel & Metals Co.

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- Roelofson Elevator Works
- Turnbull Elevator Co.

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- American Enamelled Brick & Tile Company

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- Canadian Sirocco Company
- Inglis Company, John
- Jenckes Machine Company
- Laurie & Lamb
- Leonard & Sons, E.
- McDougall Caledonian Iron Wks.
- Mussens Limited
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- Bowman & Connor
- Campbell, R.
- Cape Company, E. G. M.
- Chipman & Power.
- Dominion Engineering & Inspection Company
- Farmer, John T.
- Galt Engineering Co., John
- Hamilton, S. W.
- Lea & Ferguson
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- McDougall, Geo. K.
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- Tyrrell, H. G.

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- Municipal Engineering & Contracting Company
- Parsons Company, G. W.

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- Sheldons Limited

Expanded Metal
- Pedlar' People Limited

Fans
- Canadian Sirocco Company
- Sheldons Limited
- Sturtevant Co. of Can., Ltd., B. F.

Fuel Economizers
- Sturtevant Co. of Can., Ltd., B. F.

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- Ferranti Electrical Co.

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- Gurley, W. & L. E.

Filters
- American Water Softener Co.

Filtration Plants
- verMehr Engineering Co., John.

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- Ontario Lime Co., Ltd.
- Smyth & Ryan

Fire Escapes
- Manitoba Bridge & Iron Works
- McGregor & McIntyre

Fireproof Doors and Windows
- Feather & Roadhouse
- Hope & Sons, Henry
- Mussens Limited
- Pedlar People Limited
- Steel & Radiation Limited

Fuse (Safety Blasting)
- Lecky & Collis

Fixtures (Gas)
- Consumers Gas Company

Floor Surface Machines
- Wayvell Chappell & Co.

Floor and Wall Tile
- Frontenac Floor & Wall Tile Co.

Folding Doors
- Springer, O. T.

Forges
- Canadian Buffalo Forge Co.
- Sheldons Limited
- Canadian Sirocco Co.

Forgings
- Canadian Billings & Spencer, Ltd.

Gas Engines
- Armstrong Mfg. Co.
- Goold, Shapley & Muir Co.

Gasoline Engines
- Armstrong Mfg. Co.
- Goold, Shapley & Muir Co.
- Mills Bros.

Glass
- Consolidated Glass Company
- Excelsior Plate Glass Co.
- Luxfer Prism Company
- Pilkington Bros.
- Toronto Plate Glass Imp't'g Co.

Hammer Drills
- Canadian Ingersoll-Rand Co.

High Pressure Pipe Lines
- Boving Company of Canada
- Pittsburgh Valve, Foundry & Construction Company

Hoisting Apparatus
- American Hoist & Derrick Co.
- Beatty & Sons, M.
- Browning Company
- Brown Hoisting Machinery Co.
- Canadian Allis-Chalmers, Ltd.
- Canadian Ingersoll-Rand Co.
- Jenckes Machine Co.
- Hopkins & Co., F. H.
- Lecky & Collis
- Marsh & Henthorn
- Morris Hoist & Crane Co., Herbert.
- Mussens Limited
- Rock and Power Machinery
- Royce Limited

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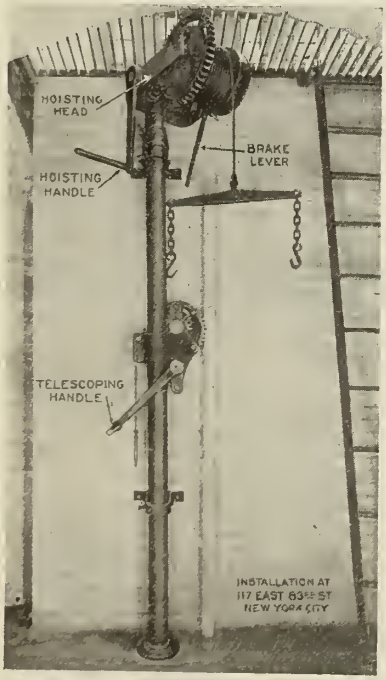
G & G TELESCOPIC HOIST (PATENTED)



Compact—easy to erect. Takes up no room in basement.

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.

1.—It is telescopic—no part showing above sidewalk when not in use.

2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.

3.—Simple in construction and absolutely rigid when erected.

4.—It is made of strongest and most durable material.

5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.

6.—A powerful ratchet device is provided with both handles above mentioned.

7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.

Hoisting head revolves. Can is deposited on Sidewalk without lifting.

Gillis & Geoghegan

549 West Broadway
New York

Black Building Supply Co., Ltd.
Agents for Ontario
Toronto

B. & S. H. Thompson & Co., Ltd.
Agents for Quebec
Montreal

W. T. Grose
Agents for Manitoba, Saskatchewan, Alberta
Winnipeg

Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

One man lifting 1800 lb. casting.

SPEAKS FOR ITSELF

to the contractor who wants to save on his pay roll.

The

LAURENT-CHERRY

CAPSTAN PULLEY BLOCK

Slack taken up on winding drum.

Just like a Hoisting Engine.

Three Sizes

No. 2 Block, ¼ or ⅜-in. Rope, Weight 3 lbs., Capacity ¼-ton......5.50
No. 4 Block, ½-in Rope, Weight 14-lbs., Capacity ¾-ton..........11.10
No. 6 Block, ⅝ or ¾-in. Rope, Weight 27 lbs., Capacity 2 tons....17.00

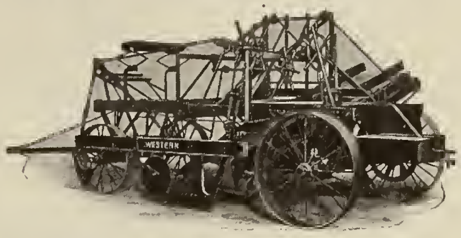
All prices f.o.b. Toronto

MILLS BROTHERS

Sole Canadian Agents and Distributors

215 Ryrie Bldg. **Toronto, Canada**

Western Elevating Graders for Wagon Loading



They are invaluable. Will load earth into as many as three 1½-yd. wagons per minute and one hundred per hour. A big saving over the old-style hand loading. Western Elevating Graders are simple in construction and economical in upkeep. They are built for day-in-and-day-out service. Every one that is interested in Road Work, Excavating Canals and Ditches, Building Levees and Embankments, should get full details in our illustrated catalog.

Western Wheeled Scraper Co.

Earth and Stone Handling Machinery

AURORA, ILLINOIS

Dominion Equipment & Supply Co., Winnipeg, Calgary, Edmonton
Agents for Manitoba, Saskatchewan and Alberta
Canadian Equipment Co., Montreal, Agents for Eastern Canada

Macadam Roads

must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

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Canadian Buffalo Forge Co.
Canadian Sirocco Co.
Sheldons Limited
Sturtevant Co. of Can., Ltd., B. F.

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Goold, Shapley & Muir Co.
Roelofson Elevator Works
Northern Crane Works

Hoisting Engines
Beatty & Sons, M.
Canadian Allis-Chalmers, Ltd.

Hydrants
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company

Industrial Cars
Central Locomotive & Car Works

Insulating Compounds
Standard Underground Cable Co. of Canada, Limited

Interior Finish and Doors
Canada Office & School Fur. Co.
Rhodes Curry & Company

Jib Cranes (all kinds)
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert

Kilns
Canadian Buffalo Forge Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.
Canadian Sirocco Company

Kyanized Spruce
Berlin Mills Company

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Dominion Lime Company
Jamieson Lime Company
Ontario Lime Company, Ltd.
Standard White Lime Co.

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Lister & Co., Ltd., R. A.

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Can. Yale & Towne Ltd.

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Boving Company of Canada
Central Locomotive & Car Works
Canadian Allis-Chalmers, Ltd.
Canadian Locomotive Company
Montreal Locomotive Works
F. H. Hopkins Company
Mussens Limited

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Greening Wire Co., B.
Metallic Roofing Co.
Noble, C. W.
Pedlar People Limited.
Steel & Radiation Ltd.

Metallic Roofing
Sarnia Metal Products Co.

Meters, Electrical
Ferranti Electrical Mfg. Co.
Canadian Allis-Chalmers, Ltd.

Mechanical Draft Apparatus
Sturtevant Co. of Can. Ltd. B., F.

Meters, Water
Hopkins & Co., F. H.
McDougall Caledonian Iron Wks
Neptune Meter Co.

Overhead Runways
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.

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Dominion Paint Works
Hopkins & Co., F. H.

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Aztec Oil Asphalt Co.
Bessemer Limestone Co.
Baker Co., R. D.
Barber Asphalt Paving Co.
Dunn Wire-Cut-Lug Brick Co.
Ontario Asphalt Block Co.
Paterson Mfg. Co., B.

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Canadian Pipe Co.
Dominion Concrete Co.
Gartshore-Thomson Pipe Co.
National Concrete Mfg. Co.
National Iron Works
National Pipe & Foundry Co.
Pacific Coast Pipe Co.
Piggott & Co., Thos.
United States Cast Iron Pipe Co.
Vancouver Wood Pipe & Tank Company.
Walsh Plate & Structural Works.
Warren Foundry & Machine Co.

Partition Hangers
Springer, O. T.

Paints (Bridge and Structural Iron and Pipe Coating)
Dominion Paint Works

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Canada Wire & Iron Goods Co.
Greening Wire Co., B.

Pipe Machinery
Sutcliffe, Speakman & Co.

Pile Driving Machinery
American Hoist & Derrick Co.
Beatty & Sons, M.
Browning Company
Brown Hoisting Machinery Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis

Pipe Fittings and Flanges
Pittsburgh Valve, Foundry & Construction Company

Plumbing Supplies
Mueller Mfg. Co., H.

Planing Mill Exhausters
Canadian Buffalo Forge Co.
Sheldons Limited
Canadian Sirocco Co.
Sturtevant Co. of Can., Ltd., B. F.

Plaster
Albert Mfg. Company
Britnell & Company
Ontario Lime Co., Ltd.

Plate Glass
Excelsior Plate Glass Co.
Pilkington Bros.

(Continued on page 16)

Made in Canada

Water Turbines
Centrifugal Pumps
Pulp and Paper Machinery

Patronize Home Industry and let us quote on your requirements.

Boving & Co. of Canada, Limited

Head Office
94 Grafton Avenue, MOOSE JAW, SASK.
164 Bay Street, TORONTO
Factory at Lindsay, Ont.
London Buildings, VANCOUVER, B. C.

Mexico City Wellington Cairo London, Eng. Tokyo Johannesburg Rio De Janeiro

Storage Bins, Capacity 2000 Tons

Crushed Stone

All Sizes

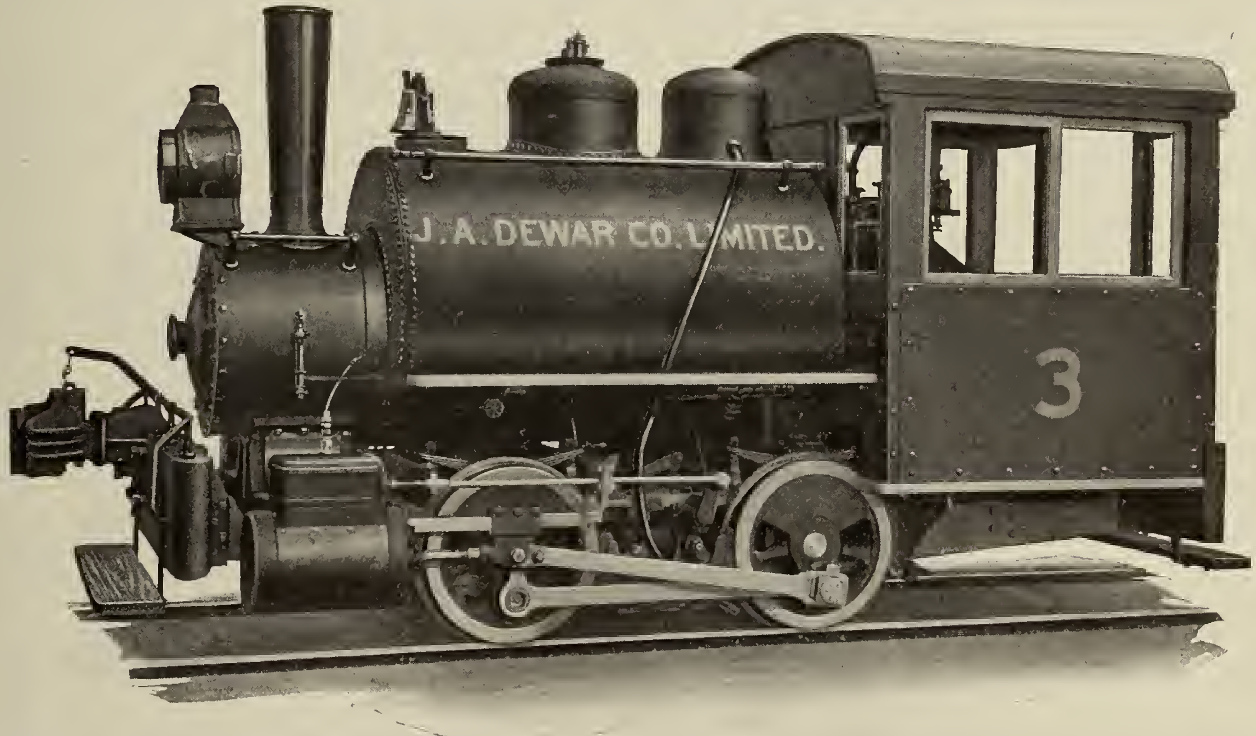
Large stock of clean stone on hand ready to ship

Best by Test for road and concrete work

Canada Crushed Stone Corporation, Limited

Dundas - Ontario

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG

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Canadian Ingersoll-Rand Co.

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Canadian Sirocco Co.
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Laurie Company, E.
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Morris Machine Works.
Smart-Turner Machine Co.
Mussens Limited
Ontario Wind Eng. & Pump Co.
Rock & Power Machinery

Portable Track
Bechtels Limited

Pulleys
Sutcliffe, Speakman & Co.

Plug Drillers
Canadian Ingersoll-Rand Co.

Power Engines
Inglis Company, John
Jenckes Machine Company
Canadian Allis-Chalmers, Ltd.

Quarry Machinery
Canadian Allis-Chalmers, Ltd.
Canadian Ingersoll-Rand Co.
Jenckes Machine Company
Lecky & Collis
George Anderson & Co.
Goodwin, Barsby & Company
Rock & Power Machinery, Ltd.

Railway Supplies
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Hopkins & Co., F. H.
Lecky & Collis
Mussens Limited

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Burlington Steel Company
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Dominion Iron & Steel Co.
Greening Wire Co., B.
Pedlar People Limited.
Steel & Radiation Ltd.
Trussed Concrete Steel Co.
Turner, C. A. P.

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H. R. Heinicke Inc.

Refrigeration Machinery
Equipment & Supplies, Limited
Keiths Limited

Road Asphalt
Asphalt & Supply Co.
Barber Asphalt Paving Co.

Road Machinery
Exeter Mfg. Co., Ltd.
General Car & Mach. Works
Jenckes Machine Company
Lecky & Collis
Morrison & Co., T. A.
Mussens Limited
Western Wheeled Scraper Co.

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Greening Wire Co., B.
Jenckes Machine Company

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Hope & Sons, Henry

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Barber Asphalt Paving Co.
Bird & Son
Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Metallic Roofing Company
Noble, Clarence W.
Paterson Mfg. Co.
Pedlar People, Limited

Safes and Vaults
Taylor, J. & J.

Sand and Gravel
Ontario Lime Co., Ltd.
York Sand and Gravel Co.

Sash Weights
Fittings, Limited

Screens
Canada Wire & Iron Goods Co.
Goodwin, Barsby & Company
Greening Wire Mfg. Co., B.
Weller Mfg. Co.

Sewerage Ejectors
British Mfrs. Assn. of Canada

Sewer Pipe
Britnell & Company
Canada Iron Corporation
Canadian Sewer Pipe Co.
Dominion Sewer Pipe Co.
Gartshore Thomson Pipe Co.
Hamilton & Toronto Sewer Pipe Co.
National Iron Works
Nova Scotia Clay Works Ltd.
Ontario Lime Co., Ltd.
Ontario Sewer Pipe Co.
Smyth & Ryan
Standard Clay Products Ltd.

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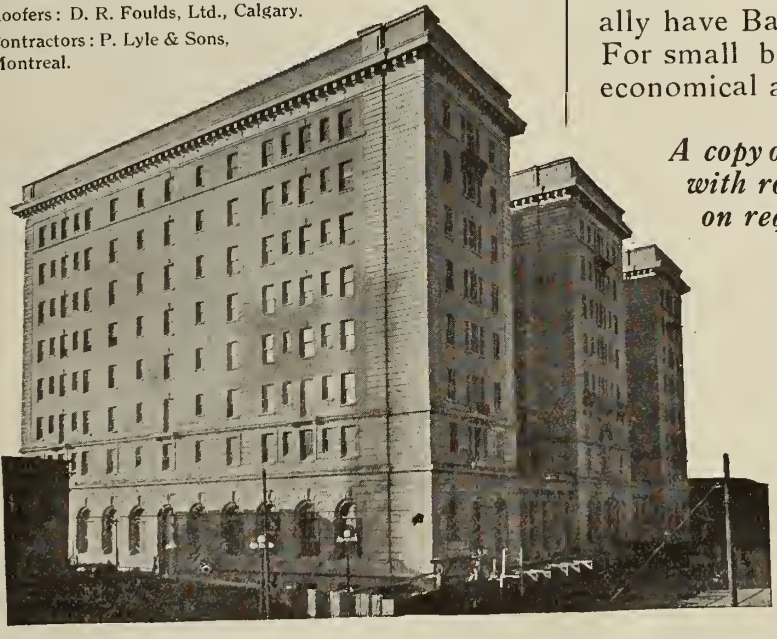

A copy of The Barrett Specification with roofing diagrams mailed free on request.

Special Notice

We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding.

If any abbreviated form is desired, however, the following is suggested:

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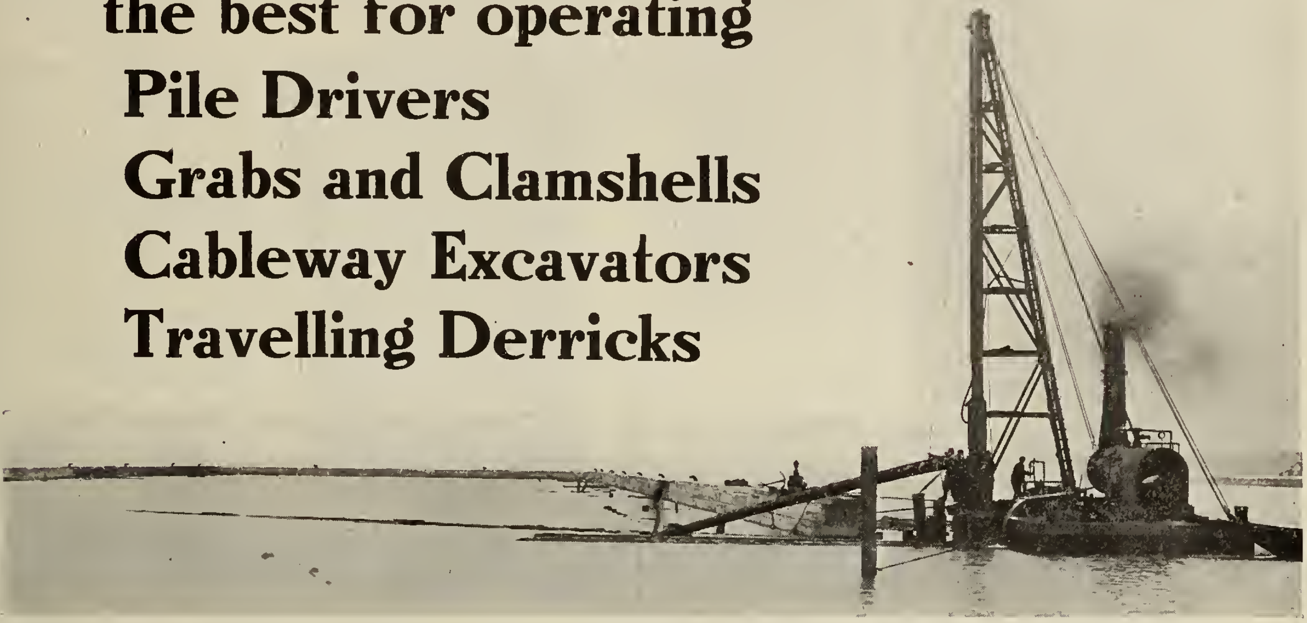

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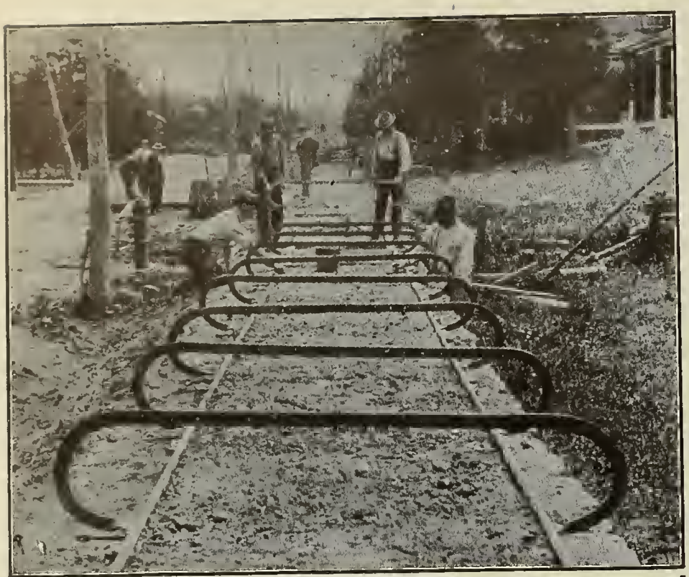

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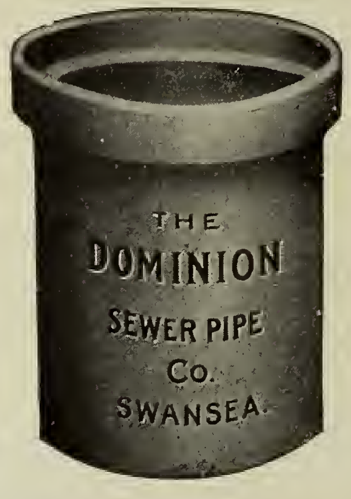

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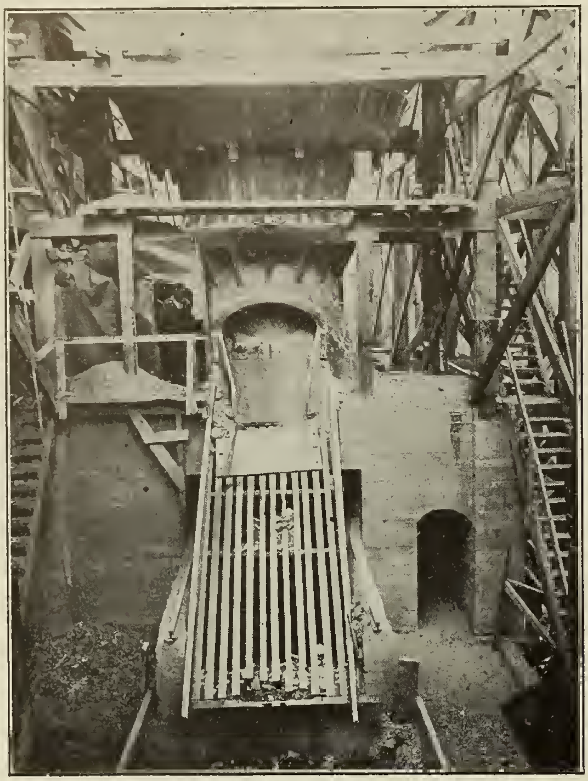

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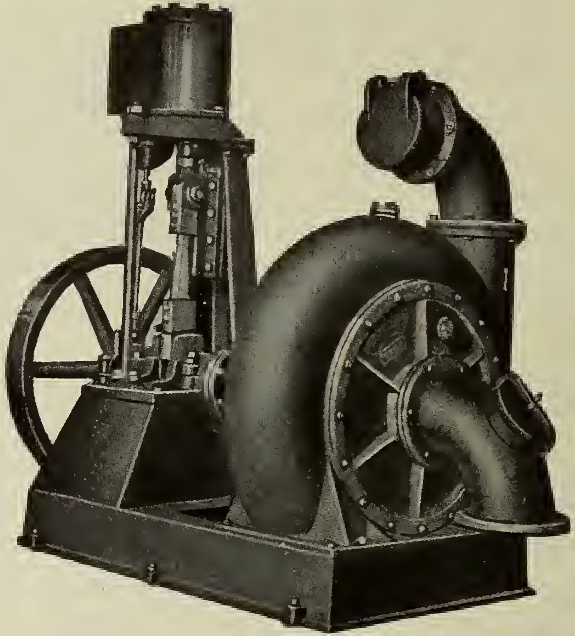

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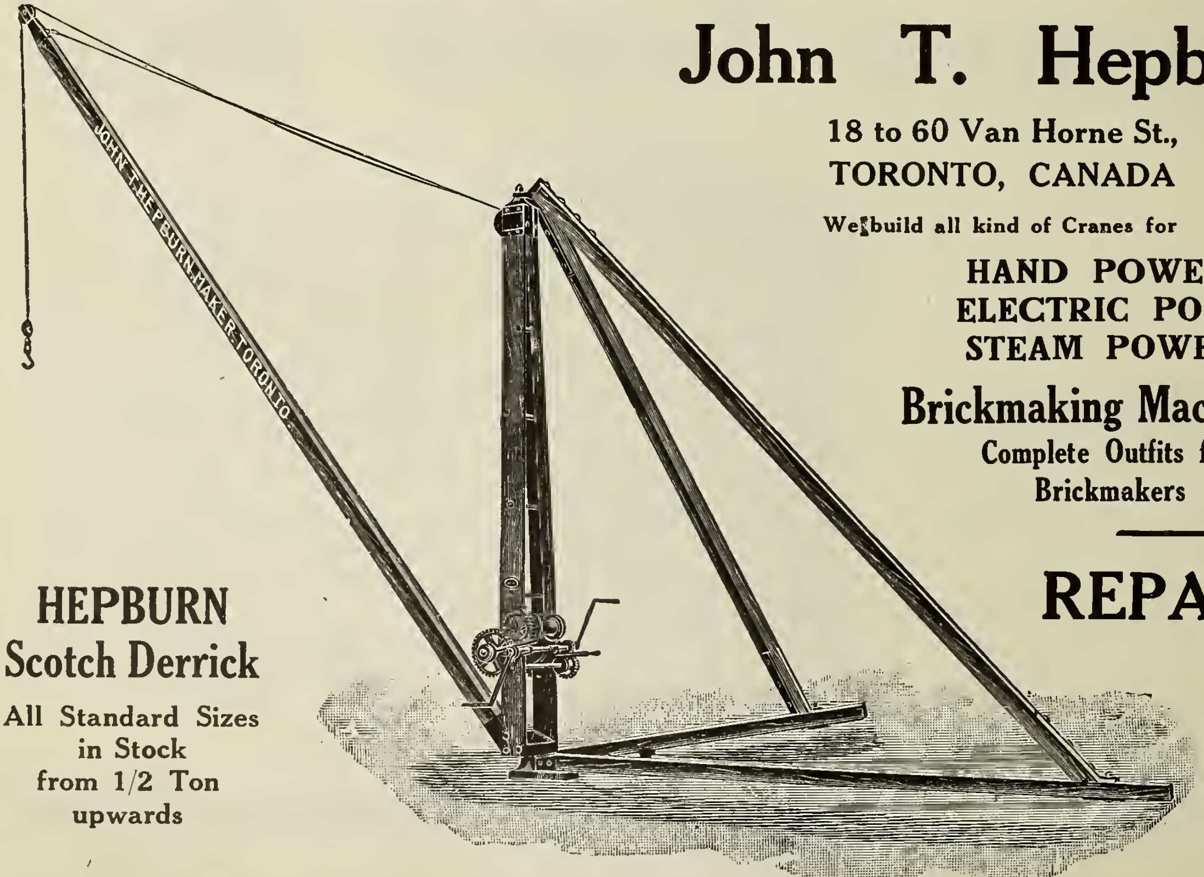
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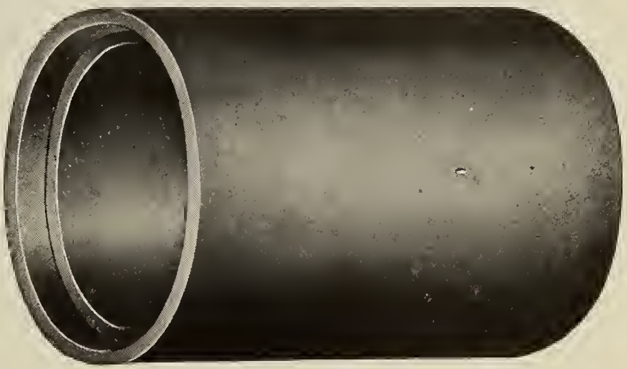

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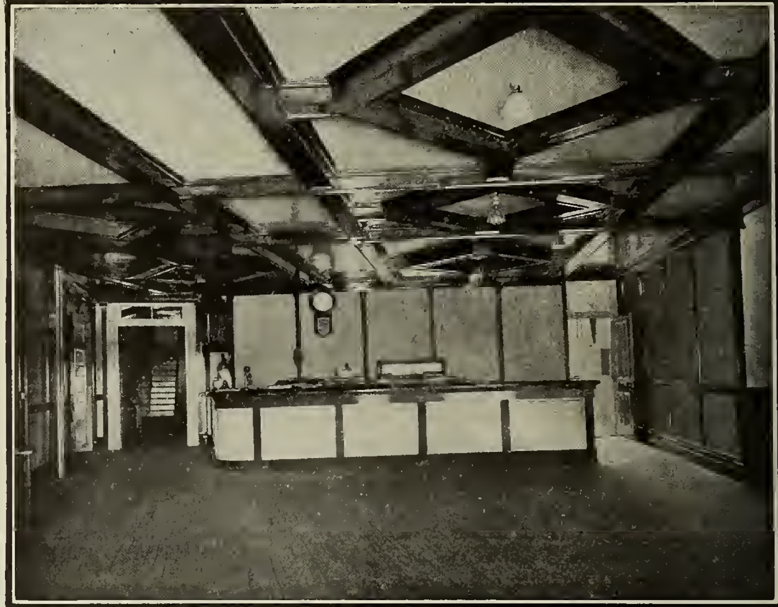

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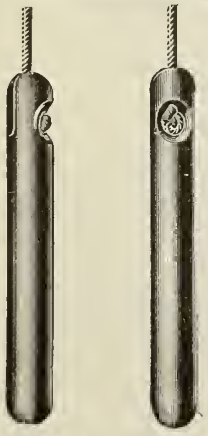

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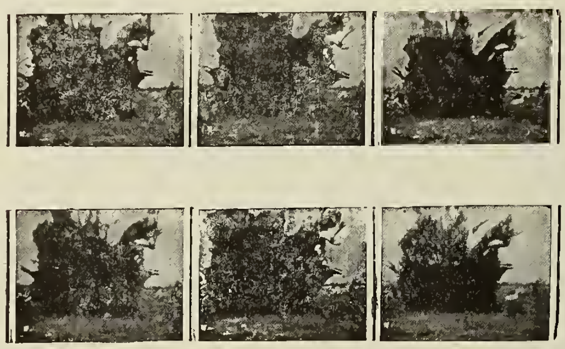

6 small bench shots like this—each one stopping work of the steam shovels, dinky engine crews and cars—and laborers.

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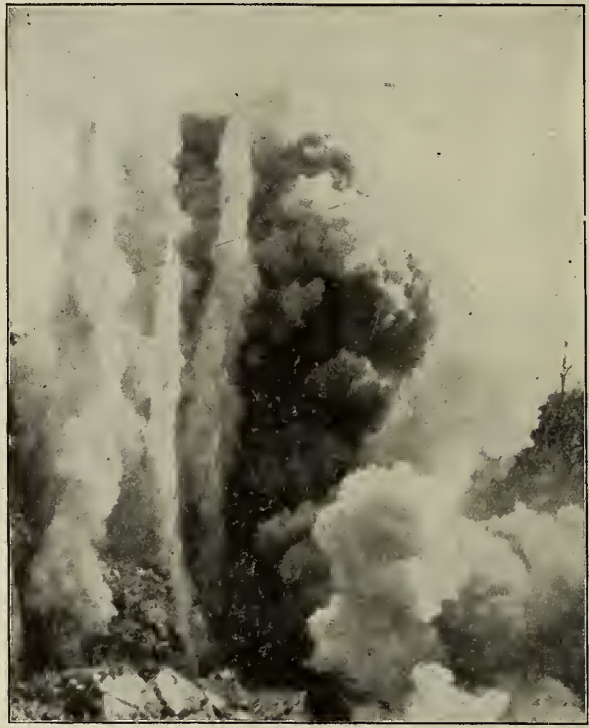


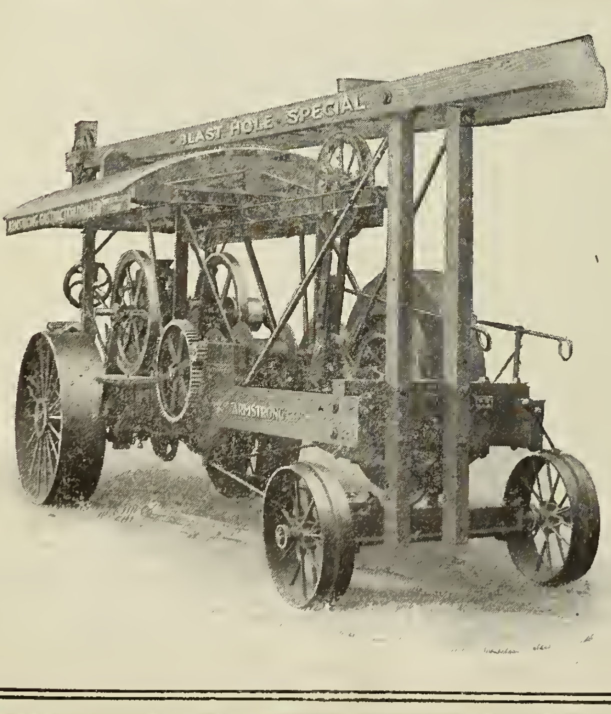
One big face blast—one stop for shovels, engine crews and cars as done by

Armstrong
BLAST HOLE DRILLS
BUILT FOR SERVICE SINCE 1867

Special Blast Hole Cable Drills

A FEW WORDS ON BLAST HOLE DRILLING

Economical blast hole drilling is a matter of getting the greatest footage of hole drilled in the shortest time with the least possible cost. The blow of the falling string of tools is the real factor in the case, and upon the conditions surrounding the action of the drilling tools depends the economy of the process. With a given weight of tools, the speed of drilling depends upon the length of the stroke, to be more exact, the actual height of drop of the tools, and the number of strokes per minute which can be freely made. These two conditions are vital to rapid and efficient blast hole drilling and are made nearly 100 per cent efficient in the "Special Armstrong Blast Hole Drill."



This is how we do it:

The "Special Armstrong Blast Hole Drill" embodies an important feature of design not found in any other type of cable drill made today, which makes possible the wonderful records which it is achieving in quarries throughout the country. The above mentioned improvement lies in the straight crank motion of the spudding beam and the proper location of the spudding sheave. It eliminates the "whipping" of the cable, it increases the lift of the tools on each stroke and makes possible a greater number of strokes per minute for a given crank throw and gives an absolutely free drop to the tools. In other words, it makes more efficient the two conditions which are required for rapid drilling, the greatest number of powerful blows; in other words, the maximum foot pounds of energy delivered at the bottom of the hole, within a time limit.

We can prove with authoritative records covering in detail periods of six months' duration that the increased efficiency of the Special Armstrong Blast Hole Drill is from 40 to 50 per cent over similar sized cable drills of other makes.

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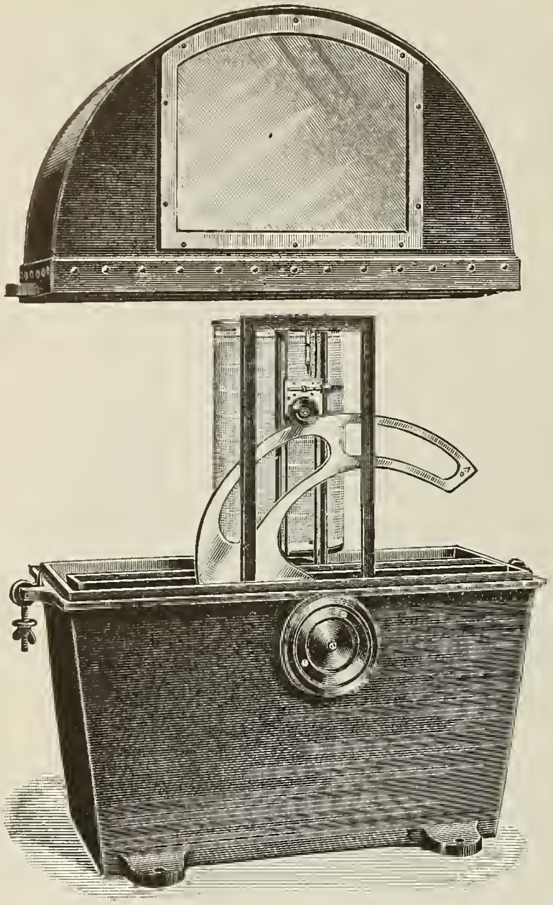

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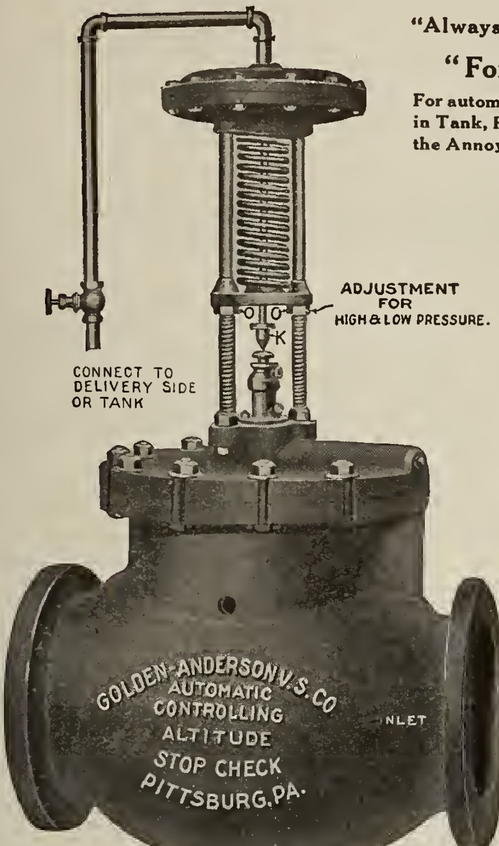

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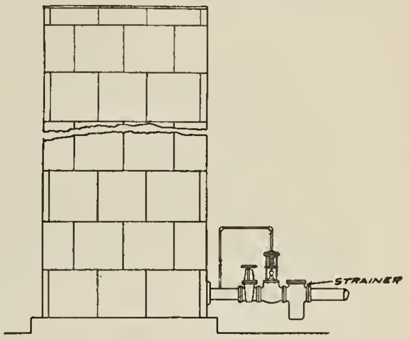

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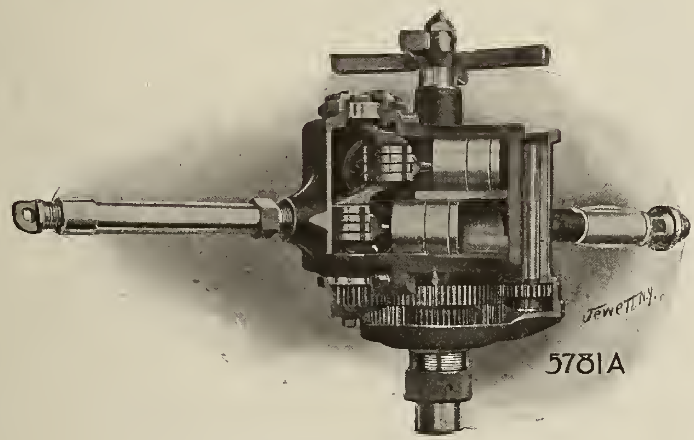

"Little David" Drill partly in section.

They are simple, sturdy, light and convenient.

"Little David" Drills embody improvements that mean real savings both in power and repair costs.

Power bills are reduced because energy is applied to the work in a most direct manner; valves are of the rotary type, quick opening, with sharp economical cut-off and smooth, silent action; ports are short, direct and amply large; there are no unnecessary motions, no unnecessary parts; every part is carefully designed and carefully made to eliminate friction and vibration as far as possible and to insure smooth free running tools.

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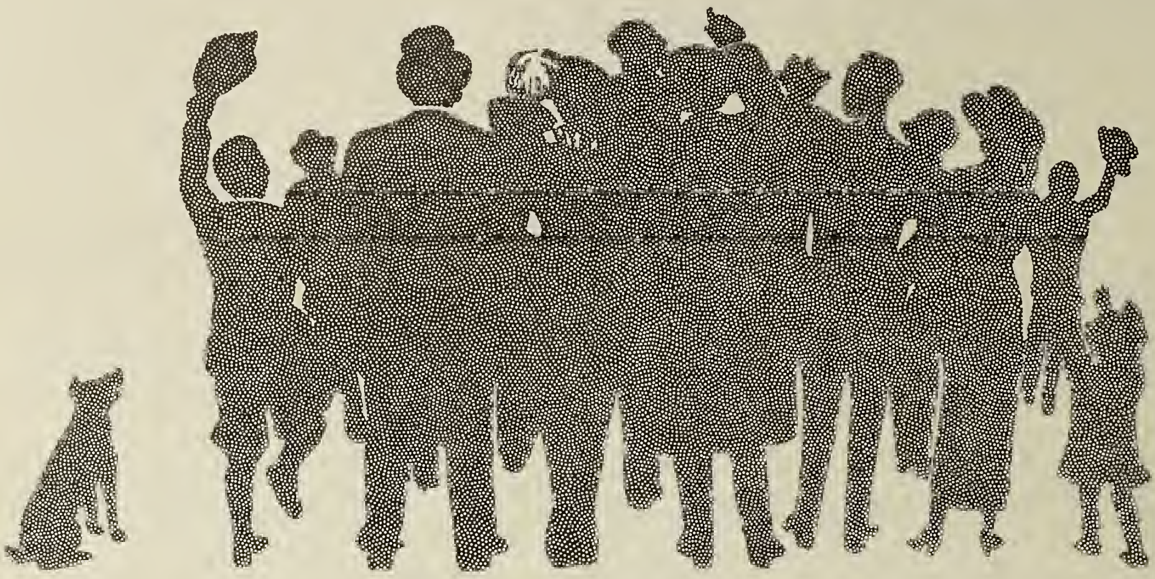

Cheering News For You

Telling how you may take advantage of conditions that help and overcome conditions that hinder

It is quite true that this war has affected business, that expenses must be reduced. But isn't it likewise true that to stay in business YOU MUST GET BUSINESS, and that to get business under present conditions DEMANDS EVERY AID THAT YOU CAN MUSTER?

Competition is going to be keener than ever, and it is the men who get the facts first that will get what business is offering. An advantage of even one day will mean the difference between getting or losing.

ASK YOURSELF THESE QUESTIONS! What does it cost you to hunt business—to find out who is buying, what is wanted, where the buyers may be found? How much useless footwork is required—how many tedious waits in outside offices—how many visits to jobs—how many unproductive calls? How many? What's the cost of the time it takes to do all this? Whatever your answer is, you will wish to have us show you how MacLean Reports make business getting quicker, easier, surer, cheaper.

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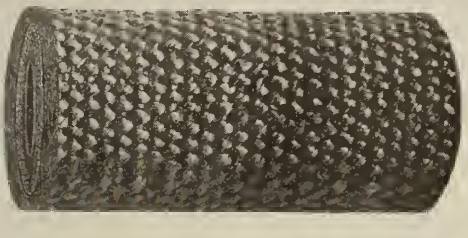

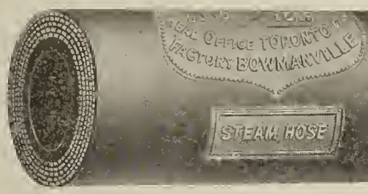

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Don't buy hose on "price." A first small "saving" is mighty poor economy compared with serious after losses resulting from breakdowns due to inferior quality.

Goodyear Hose gives you service and **service-insurance.** Goodyear products are not made to meet a price. No other master-standard is the gauge of quality. Each Goodyear product is designed and made to set a new super-standard in its particular field. Made to be worthy the Goodyear name and prestige. Made to more than pay for itself in actual service rendered. And service is always true economy.

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GOOD YEAR
TORONTO

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Your business development is largely the result of the service you render; and every Goodyear product is a service product. The Goodyear line carries no after-regrets with it. It is a line you can depend upon day in and day out—month in and month out.

Write to-day. Asking questions costs you nothing—places you under no obligation. And Goodyear products are home products, made in the Goodyear factory at Bowmanville, Ontario.

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Durable,
Non-Fading RED

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ESTABLISHED 1886

Contract Record and Engineering Review

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Meeting the Present with an Eye to the Future

WAYS and means of meeting the situation brought about by the war must not be lost sight of in the optimistic view that hostilities are likely to be over at an early date and that business will soon resume its normal course. At all times we must do our best to impart confidence and optimism, but however sure we may be of the future we cannot evade the responsibilities of the present.

So it is that we commend the action of the Montreal Builders' Exchange in the efforts which they are putting forth to determine the most satisfactory course in the interests of both employer and employee. At the meetings which this Exchange has convened recently, there seems to have been unanimity of opinion regarding several fundamental aspects. In the first place it is agreed that if capitalists are to be induced to undertake new buildings they must be encouraged by reduced cost and that this reduction in cost can be brought about only by the careful co-operation of master and man. It seems to us that much more hinges upon such co-operation than is popularly believed.

The banks have been criticized for their unfavorable attitude in regard to the financing of new undertakings and it has been suggested that pressure should be brought to bear upon the Bankers' Association and the Minister of Finance—indeed the Montreal Exchange has appointed special committees with a view to approaching these authorities. But what pressure can be brought to bear? When the Exchange has such a good purpose in view we hesitate to criticize its action, but we fail to find any encouragement for expecting great things of the banks. These institutions have their own responsibilities. They have to hold themselves in readiness to meet the possibility of unprecedented demand, and most of them have government obligations which must be watched closely; moreover, if their funds were available for new constructional projects, probably they would be pleased to arrange terms of finance, as these could be effected on favorable terms.

If any impetus is to be given to constructional operations the momentum must come from within. Contractors, supply houses and workmen must be prepared to sacrifice uniformly. The contractor must cut his profits; the supply dealer must effect a revision of his schedule, and the mechanic must resign himself to the period of economy which will ensue upon a lower wage.

Hitherto, capital and labor have been opposed in their respective ends. Each has succeeded in face of, if not because of, the other's opposition. Now the order of things is reversed. If the men who are arrayed on the side of capital close their fist and the workmen take up the challenge, the result will be disastrous. As soon as there are no workmen, the wheels of industry cease to revolve. With no work in progress the stability of the country is gone and the interests upon which capital depends collapse like a pack of cards. Meanwhile, the workmen, with no work, and arrayed in opposition to capital, starve. These are only the fundamental principles of economics, but after all the whole structure of humanity is dependent upon the observance of the fundamental elements, and their violation brings the inevitable consequences.

This is somewhat of a digression, but it may serve to call attention to the seriousness of the action of some of the unions in refusing to consider any reduced scale of wages. At Montreal, the representatives of one of the labor organizations actually told a large contractor of our acquaintance that he would rather eat from the soup kitchen than have wages reduced one cent an hour. One can only characterize such an expression as foolish and the man who gave vent to it as a fool. Workmen are vitally interested in such efforts as the Montreal Builders' Exchange are making and they must co-operate with a view to affording a stimulus to constructional enterprise. The whole secret of such stimulus is lower cost. It has been suggested that there be a general reduction in wages to apply on all work contracted for during the last four months of 1914. We endorse the suggestion, knowing it to be only a temporary arrangement looking to the fulfilment of a wise purpose. It is one means of continuing employment and maintaining the stability of the whole business structure.

Mention building operations to the prospective builder now and he will probably offer as an excuse for postponement the existing high rates of interest. Offset this argument by telling him that the cost of building has been reduced to a figure which he will never see again in his natural life and it will set him thinking.

Certain it is that the various interests identified with constructional operations must do some hard thinking, and they must think quickly and wisely and well. A conservative, co-operative policy—inspired by that confidence which has built up British business to its present enviable position—**put into effect now** will meet the present situation and lead us to ultimate prosperity on a scale which will compensate for all temporary trials.

Building Industries and the Future

A Review of the Situation in the Old Country, by the London "Builder" —British Government Urged to Come to the Assistance of the Banks

DURING the long period of peace which followed the conclusion of the great Napoleonic struggle our industries had no continental rivalry to struggle against for sixty or seventy years, and could easily hold their own in neutral markets; but the enormous development of the United States and Germany during the last thirty years has resulted in steady pressure being directed to undermine our influence in neutral markets and to destroy our commercial position, and this has been largely helped by the organized support of Governments and banks. Whereas we produced more iron than any country thirty years ago, we have now sunk to the position of the third largest iron-producing country, having been passed first by the United States and then by Germany.

To a great extent this has been the result of factors which we cannot hope to cope with, such as the development of the almost boundless resources of the United States, coupled with an enormous growth of its population recruited from that of every country in the Old World. But the growth of Germany as a commercial power has been largely effected by the careful manner in which her industries have been fostered by her Government, which has enlisted the help of science in many of them.

The building industries are not largely affected by foreign competition, except in sheet and other forms of glass used in building, and in electrical work; but, as these industries require a large amount of expensive plant and would employ a number of men, we hope the opportunity may be taken to create a native supply for the building trade in these materials, while the subsidization of the glass industry in some form or other might be usefully considered.

With regard to steel, we trust that manufacturers will not raise prices unless it is absolutely necessary for them to do so, as this would operate in checking building enterprise; but we do not believe that large or substantial advances are likely to be made.

A shortage of spelter may affect some trades, but we hope this will adjust as time goes on; and this may be said with even greater confidence of timber, since many sources of supply will remain open and be available.

The chief obstacle to immediate prosperity in the building trade is, we have gathered, the withholding of the usual credit given by the banks, and this is a matter so essential to the prosperity of the trade that we consider a clear case has been made out for the benevolent action of the Government. To re-establish the normal machinery of credit will enable men employed in the second largest industry in the country to be kept employed, and will be infinitely cheaper to the State than keeping these same men in a state of unemployment. If the Government lost a little money in doing so—and we do not see why it should—it would save much in the prevention of unemployment. And it must be remembered that the good done does not affect employers and men alone, but a whole group of industries connected with building and entirely dependent on it. So that assistance given to the banks would be an exceedingly cheap method of securing an excellent result, and one which would have a material, though indirect, effect on the struggle in which we are engaged.

It would be but employing in an emergency the method which Germany systematically uses in normal times for the development of her industries. German banks, which act in conjunction with the Government, have supported German trade in circumstances in which no English banking facilities would have been afforded, and have been a great factor in her extraordinarily rapid commercial development. While we have been termed a nation of shopkeepers, the Germans have proved themselves to be a nation of commercial organisers by a system which can best be described as the union of Governmental and private enterprise. We have said we regard the prospects of the building trade as good, but to secure the result wanted the Government must be shown clearly how best the present difficulties can be met, and the building industries should make the state of things absolutely clear to those in authority.

"Considerable Activity may be Looked for in Great Britain," says Ferro-Concrete

"Instead of limiting the enterprises of local authorities and other public bodies and restricting labor and the output of plant and materials, it is plainly evident that the war will cause an immediate boom. On the suggestion of the Local Government Board, most of the corporations and district councils in the country have already decided to prepare and carry out important schemes of building and engineering in order that during the coming winter full employment may be found for every workman, and so that any men thrown out of work from other industries may be kept fully employed. Special facilities for the immediate execution of such schemes will be afforded by loans and by grants from the Local Government Board and the Road Board. Merchants and manufacturers of plant and materials for municipalities will act wisely in making preparations well in advance for the demands which will immediately be made upon them. It may also be mentioned that Parliament has passed the Housing (No. 2) Act, and that four millions sterling are to be spent in the erection of labourers' cottages. Moreover H.M. Office of Works have decided to proceed with all services in their charge, to employ as many men as possible to carry out such services, and to develop and expedite their building programme in any way practicable. The Commissioners of Works express the hope that private individuals, companies, firms and contractors will spare no effort to follow the policy of the Government in this matter."—Ferro-Concrete.

Sir George Foster's Advice

"What we cannot supply ourselves, let us purchase from Great Britain and other parts of the Empire. Let us covenant together to buy goods 'Made in Canada,' 'Made in Britain' and 'Made in the Empire.' Thus shall we give employment, and the profits of production to the Empire's home workers. Then let us find the details of what Germany and Austria have produced and sold to other countries, and set ourselves to supply as large a part of this as possible. Here are markets for hundreds of millions worth of products, the making of even a portion of which will keep our industries going and give employment to hundreds of thousands of our people. If consumers determine to buy only Canadian and Imperial goods, and producers to provide them at lowest prices and of good quality, a co-operative work of inestimable value will have been begun."—Sir George Foster.

A quick method of breaking up the granite setts or other material used between tramway tracks has been successfully employed in Cleveland. Previous to any track work, where it is necessary to break up the paving, a special plough is hauled by a service tramcar over the section on which the work is to be done. The plough consists of a heavy steel casting of suitable shape for lifting the paving blocks and for cutting the tie rods at the same time. It is pulled by a service motor car which is equipped with four Westinghouse motors and high-tension control. The weight of the motor car with load is about 50 tons. The weight of the plough car together with its counterweight is about 11 tons. Three men and the crew of the motor car are all that are needed to operate the machine. It has been found that with this plough 1,300 square feet of pavement can be broken up in one minute. On one occasion the pavement in a stretch of track 2,600 ft. long was removed in thirty-five minutes. Only such slight difficulties as the breaking of the cable which pulls the plough have been experienced up to the present. The plough is only used once or twice a week, for an hour's work with it will give enough track to work on for eight to twelve days.

Chilliwack, B. C., Sewerage Scheme

THE scheme for the sewering of the city of Chilliwack was designed by Messrs. Cleveland & Cameron, engineers, Vancouver, and the work is being carried out under their supervision by the firm of Messrs. Robert McLean & Company, contractors, Vancouver.

Chilliwack is situated on a level plain on the left bank of the Fraser River. During high water on the Fraser in the summer when the rise is extreme, the level of the city is below the level of high water. A most efficient system of dyking surrounding the greater part of the city site was constructed years ago. The average formation in the city consists in depths of seven to nine feet of alluvial deposit over-lying quicksand and gravel. Where the alluvium is of sufficient depth the work of sewering is about as easy as it is in any formation, but when the depth of the sewer penetrates the sand and gravel the work becomes one of exteme difficulty.

The necessity of providing for the draining of basements in the business part of the city causes the sewers to be laid a depth of over 10 feet, and for a considerable distance the system is below the quicksand.

The original scheme provided for the use of pneumatic ejectors at two or more points within the district, but the cost of these was prohibitive and the scheme being carried out consists of outfall works placed at sufficient height, pumping chamber at the lowest point in the district, and a series of sewers ranging from 12-in. to 6-in. in diameter, with a rising main from the pump well to the outfall works. The scheme is on the separator system of sewerage.

The cost of the works will be about $35,000.

The sewers are constructed with vitrified pipes, jointed with neat cement, with the usual manholes built in concrete at intersections and changes of gradient. The pumping chamber is constructed of concrete, the upper portion of which contains the pumping machinery. This consists of centrifugal pumps in triplicate, supplied by the Canadian Fairbanks-Morse Company, of Vancouver, driven by the Squirrel Cage type of electrical induction motors, the sewage from that point being delivered by the rising main to the outfall works on land on the bank of the Lilly slough. Each pump has a capacity of 200 gallons per minute against a total head of 33 feet. The outfall work consists of detrital chamber and separator chamber in duplicate, each provided with controlling valves for alternating the flow and for removing the solids. The detrital tanks are of the usual hopper bottom shape with surface scum boards.

By this combination over 90 per cent. of the solids in suspension are removed, producing an effluent sufficiently clarified to be discharged into a stream or for further purification on filters. The detrital tanks and separator are built entirely of concrete.

The above scheme provides for the sewerage from a population of 5,000 at the rate of 100 gallons per head per day.

The Evolution of Modern Elevator Construction[*]

By James Spelman, M. Can. Soc. C.E., Montreal

THE question of storing grain is probably as old as civilization. Since the time when men began to cultivate the land the resulting crop had to be held at least a twelve-month. Later on, the necessity of making the crops of a bountiful year last over into lean years led to the storage of the grain for longer periods.

Fig. 1 is taken from a wall painting in the Tombs in Thebes. It shows two granaries with conical domes that were used at one of the large houses. Fig. 2 is a cross section of some silos that were used by the early Egyptians, also taken from a recently discovered wall painting. In this are shown all the fundamentals of the grain elevator. The grain was received in the pile at the right of the picture and measured in a measuring basket by the man on the right. It was then carried by the other men walking up the stairs to the top of the bins, from which primitive elevators the modern term elevator leg has been derived. The grain was poured in at the top and taken out at the bottom when required, and the markings on the bin walls are supposed to indicate the character of the grain. The bins were not two-storey affairs, as might be judged from the illustration: the Egyptian method of showing that there was something in the background was to place it on top of what was in the foreground. Simple as this process is it conveys the idea of the modern elevator. The grain was received, weighed or measured, put into the different bins according to grade and taken out at the bottom. Prescott in his "Conquest of Peru" mentions that the Incas stored grain and that they sometimes had on hand a supply which would last the immediate neighborhood for ten years.

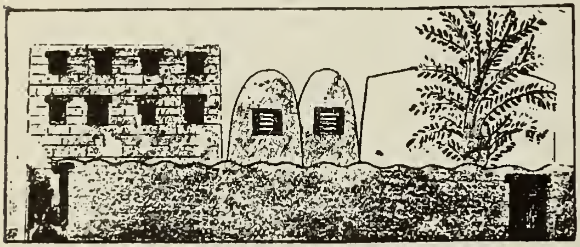

Fig. 1—Type of granaries built by the early Egyptians.

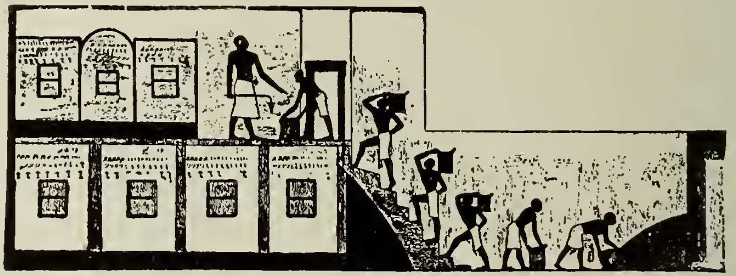

Fig. 2—Cross section of silos used by the Egyptians.

An elevator as built at present provides means for receiving the grain, places in which to put it and appliances for delivering it. It also provides machinery for weighing it both when it is received and when it is delivered. There are several kinds of elevators, the design depending on the location, the local conditions and the business that is to be performed.

An interesting problem arose during the construction of an elevator at Port McNicoll, as to the proper mixture of cement, sand and stone to be used in the concrete. The cost of the cement delivered at the mixer was $1.38 per bbl. and that of the gravel unloaded in the pile at the elevated track 38 cents a yard. The screened stone after passing through the screening plant was worth $1.70. There was so much of the sand that it was not considered as having any value except for filling purposes, and the cost of the concrete mixture would depend on the allowance which the railway company might be willing to make for it. About thirty per cent. of the pit gravel delivered was stone and seventy per cent. was sand. After washing, a very good sand with about twenty-five per cent. of voids was obtained. The mixture under these conditions would cost from $3.25 to $3.71 per yard for 1-3-5 mixture, depending on what was allowed for the waste. If thirty cents were allowed it would cost $3.25, and if no allowance were made it would be $3.71. After figuring on what the different mixtures would cost with different allowances for the waste it was found that if twenty cents were granted the cost of a 1-3-2 mixture would be the same as a 1-3-6 mixture, a most unique condition.

During the construction the supply of stone failed and it was decided to put in sand, the only objection being that the mortar would stick and not run out of the buggies. It was, however, possible to use enough stone to keep the buggies clean. The material averaged $3.38 a yard for concrete when placed over the mixers. The arrangement for mixing was good, the mixer being placed directly under the bins and discharging to buckets in the hoist tower which carried the material to the top of the building. Concrete was deposited in the bin walls for 80 cents a yard from the mixer, making the cost of the concrete in the walls about $4.20.

The Port McNicoll elevator storage house covers one acre, the entire building being of concrete and steel. Recently another unit of the same size has been added.

Years ago elevators were built principally of wood, as it was the cheapest material. In fact, up to about the middle of the nineties very little else was used. The elevator builder in most cases developed from a good carpenter. Not much technical engineering talent was employed, the ingenuity displayed being that of the natural mechanic. These men knew very little about grain pressures, but they soon discovered what thicknesses of walls were required for bins of various sizes and that if the bins were built too high the timber below would crush. The construction was gradually developed so that the minimum amount of material was used to carry the loads safely. The re-

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[*] Abridged version of a paper before the Canadian Society of Civil Engineers.

Figs. 3 and 4—Reinforced concrete elevator construction in progress at Manchester, Eng.

sult was that, in wooden elevators, loads were used that would not be tolerated by other engineers. For instance, the side pressure in some of the old wooden elevators was 600 or 700 pounds on oak. A strict interpretation of most city ordinances would make it necessary to add very materially to the amount of timber used in the ordinary wooden elevator. One of the reasons why such pressures can be used is that the load in the elevator is an ideal load. It comes on easily and is taken off easily, without shocks or jars of any kind.

To illustrate how closely men worked in those days, there was one elevator in which about 65 or 70 feet of cribbing was shown on the plans. The owner asked to have fifteen feet more put on. It was objected that the posts would shove up into the girders. He stated that he was only going to use the building to store oats, which were much lighter than wheat, and he therefore could afford to take a chance in building so much higher. The owner finally assumed all responsibility for the additional height and stated that he was not going to fill the elevator with anything but oats. Six months later the posts had gone two and a half inches into the timbers, and on investigation it was found that the first time the elevator was filled it was with wheat.

About the middle of the nineties there began to be a demand for the fireproof elevator. The increase in insurance rates and in the cost of timber led to the inquiry as to whether something better than wood could not be obtained. Steel was first used, then tile, and afterwards concrete. About the time that the building of fireproof elevators was proposed, those who were in the business of constructing elevators realized that they knew very little about grain pressures. It was all very well to build in wood, in connection with which experience had been gained, but in order to make a proper design for a building in steel, or tile, or concrete, it was very necessary to know what the side pressure and the down pressure and all pressures amounted to, at least approximately. At that time knowledge with regard to bin pressure consisted of one fact. Someone had demonstrated that if a bin were filled with grain the pressure at the bottom would

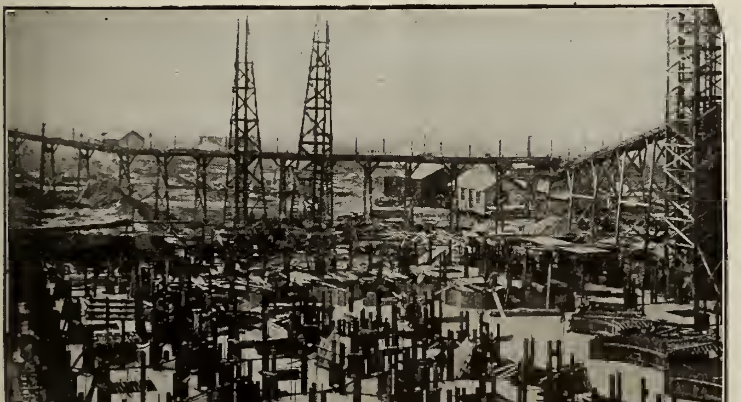


Fig. 5—Form work for bins at Fort William, Ont.

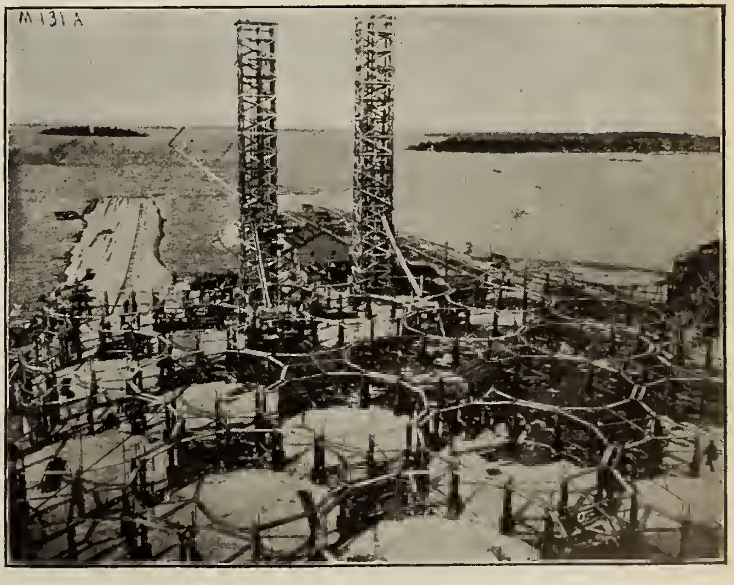


Fig. 6—Elevator construction work at Port McNicoll.

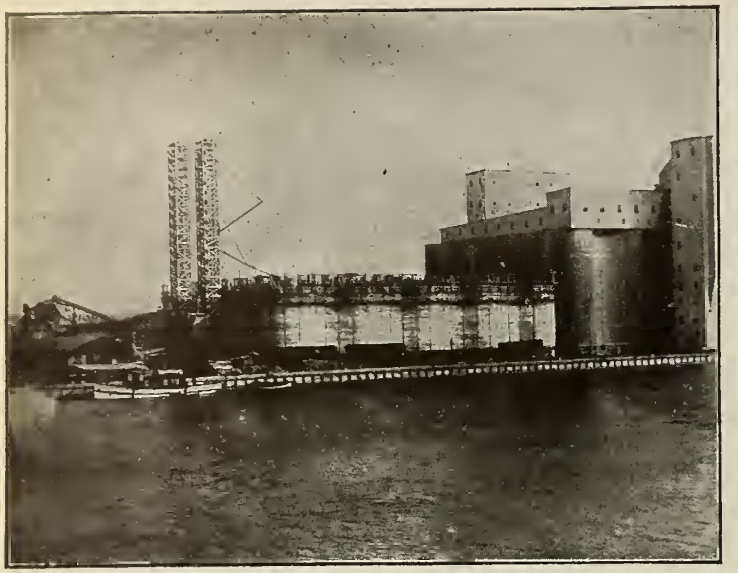


Fig 7—Port McNicoll construction. Form work in progress.

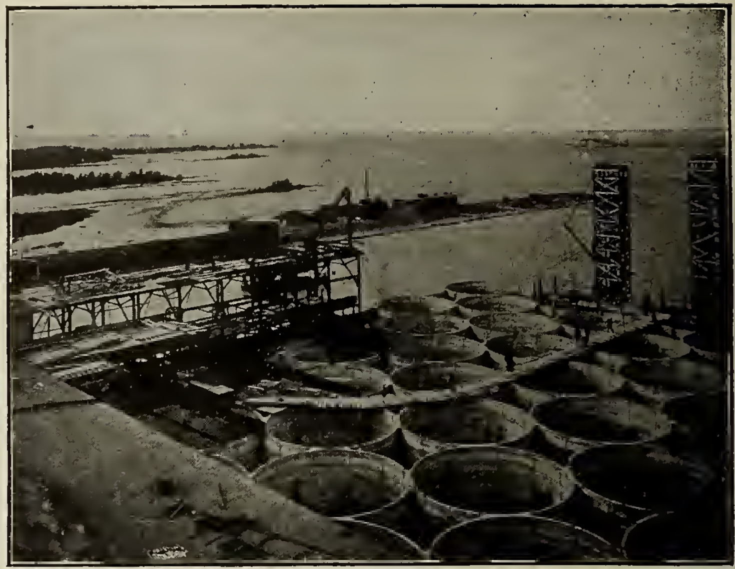


Fig. 8—Port McNicoll construction. Forms removed from bins.

be about equal to the weight of grain in a cone with a base equal to the bottom, and of a height three diameters at the base. This was arrived at by experiment, but the side pressure was not known. It was found that after a bin was filled to a height of about three times the diameter of the base, it did not matter how much more was put in, because the pressure on the bottom did not increase, and from this it was an easy matter to demonstrate that the pressures on the side were uniform for each succeeding foot up from the bottom, until near the top, but the amount of these pressures was not known.

Everyone who thought about the matter knew that it had something to do with the friction of the grain on the wall, and finally it was found that it would take two pounds, at least, to hold a pound of grain against the wall. The pressure might be more than two pounds, but it could not be anything less. Many engineers engaged in the business made more or less correct experiments to determine the pressure. An experiment with a bin about eighteen inches square, with three sides solid and one side with wooden slats was made by the author. These slats were kept apart so that each acted independently. Each slat was tested with a centre load to find how much it would take to deflect it a certain amount, the stronger of the slats were selected and put at the bottom, and each one labelled with the load it would carry for a certain deflection. It was found that the side pressure was everywhere very nearly twice the weight of the grain held against the slat, but that as soon as a small hole in the bottom was opened and the grain allowed to trickle out, the slats bent a great deal more because of the change in conditions. It was estimated that the pressure on the bin walls when the grain was in motion was about three times the weight of the grain pressing against it. This very simple rule was adopted about the year 1898, and since then elevators have been built on that assumption. Although a lot of good work has been done in the investigation of grain pressure in more recent years the author has seen no occasion for changing this rule. It figures just a little more than some of the rules employed; a little more, possibly, than Mr. Jamieson's experiments, and is just

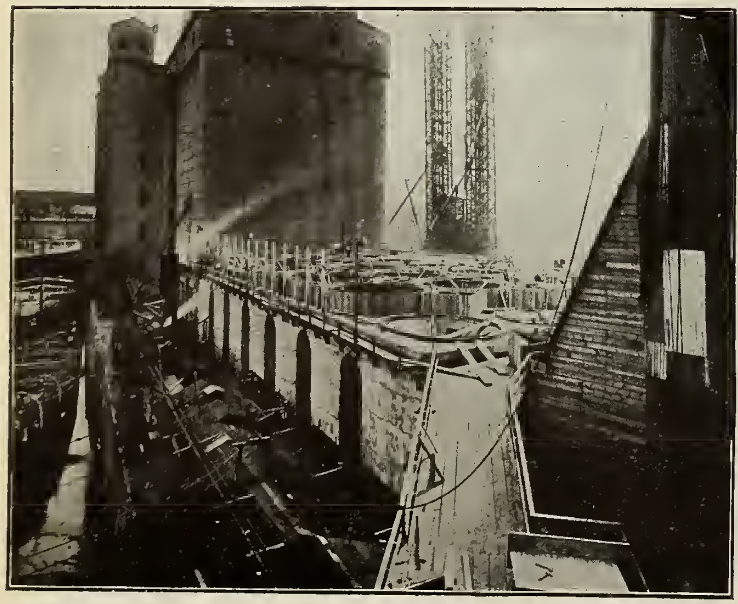


Fig. 9 -Form work in progress at Elevator No. 1, Montreal harbor.

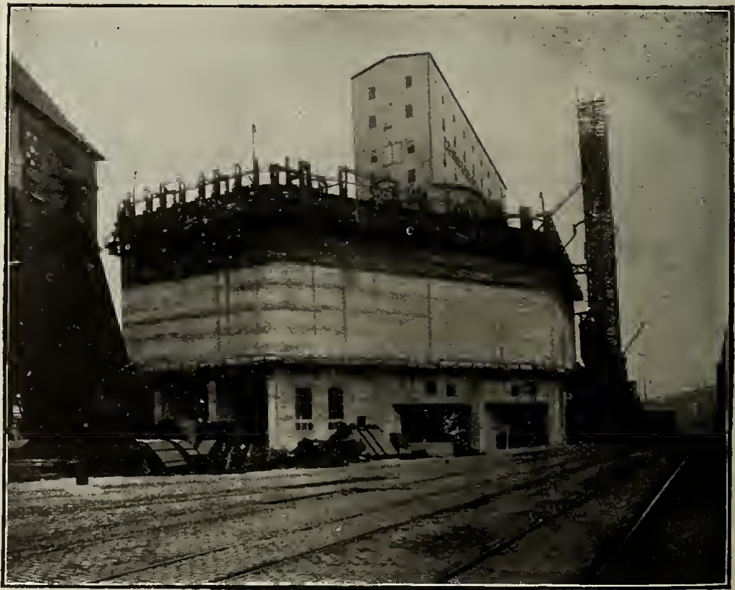


Fig. 10—Montreal harbor elevator. One week's progress on forms.

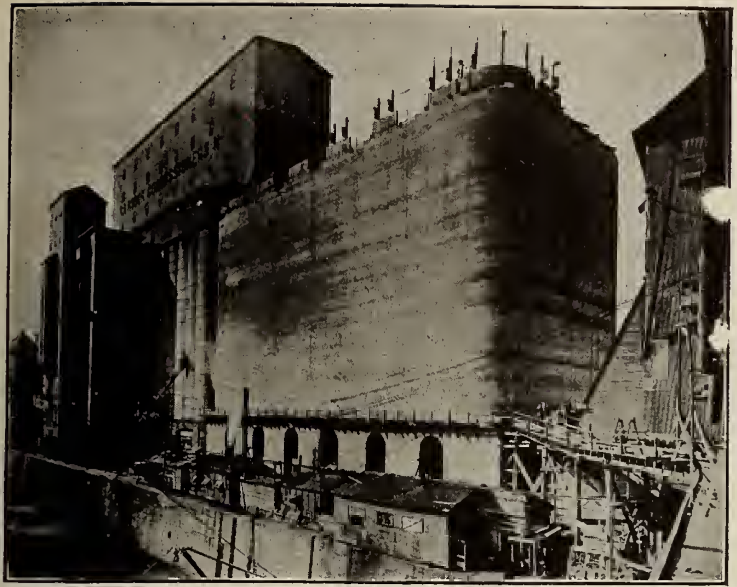


Fig. 11—Montreal harbor elevator. Forms removed from top of bins.

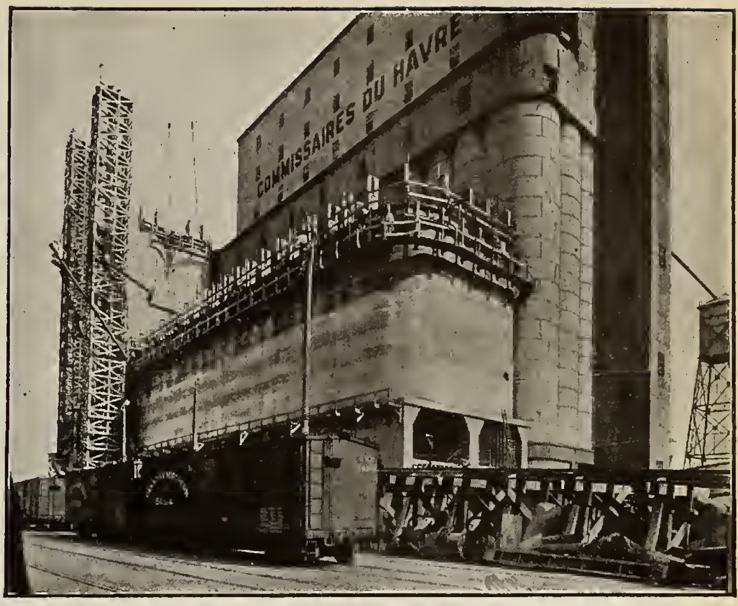


Fig. 12—Montreal harbor elevator. View of bins from land side.

a little safer. These experiments were followed with an experimental bin which was built in this city before the Windmill Point elevator was put up, and from that bin the pressures were determined.

In the experiments with the small bin with the slats on one side of it one peculiarity was especially noticed. The bin was filled up to the top, struck off level, and then a slide was opened on the bottom and a portion of the grain allowed to run out. The slats on the side bulged out, making the bin a little bigger. The grain, however, that had been taken out at the bottom could not be put in at the top without heaping. This showed that when the grain fell into the bin it packed pretty well near the bottom, and when the bottom slides opened and allowed some of the grain to flow out there was an area of grain in the immediate neighborhood of the opening less dense than the grain in other parts of the bin. With a glass side in the bin it was possible to see the grain arch over. The point where the little kernels held up the under side of the arch could be seen, and as the grain went out at the bottom the under side of the arch crumbled off. The pull of the grain on any obstruction that meets its path in the bin is quite strong. In steel elevators considerable difficulty has been experienced because the tie bars across the bins pulled out the rivets. Apparently enough rivets were figured for the strain due to the load on the edge of the bars, but the suction of grain on the side of the five-inch flat bars would pull them down, twist them over and pull the rivets off. Of course, this was not so apparent with round bars. In one case of round bars, an elevator was built with bins that were twelve feet by twenty-four feet, and about seventy feet deep, rodded in the middle. There were two openings in the bin, one in the centre of each of the twelve feet square portions of the bottom, and these rods, of course, were in a line up the middle of the bin. The builder of that elevator was apparently afraid of the suction of the grain on the rods, and in order to overcome it 6 x 6 posts were put up in the centre of the bin to support each rod so that the down pull of the grain would not break the rod. Whenever the valve at one side of these rods was opened at the bottom of the bin there was a suction of the grain

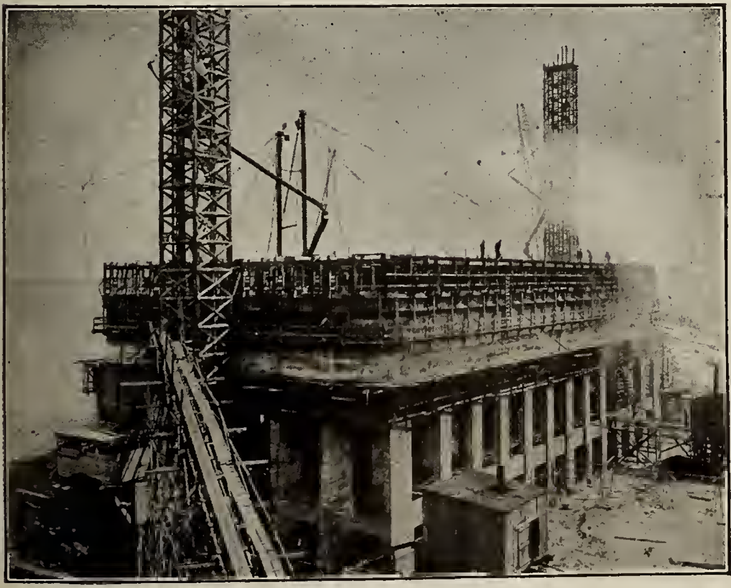


Fig. 13—Elevator construction at St. John, N. B.

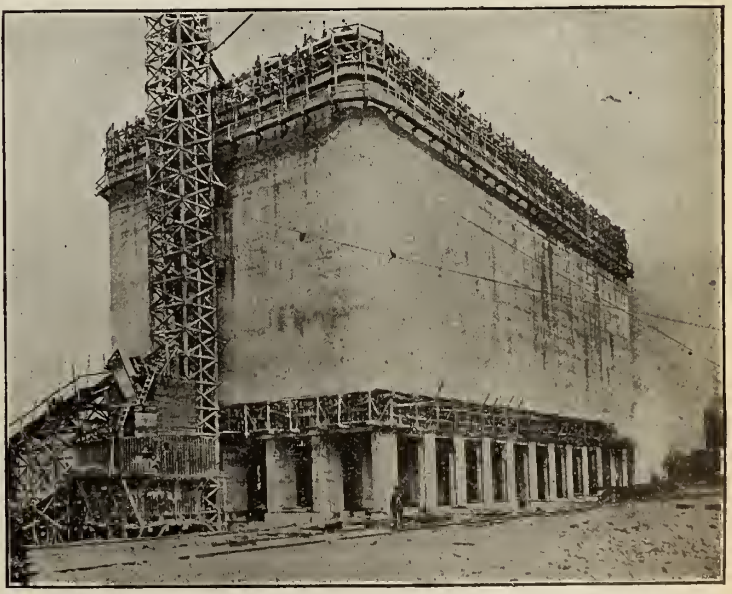
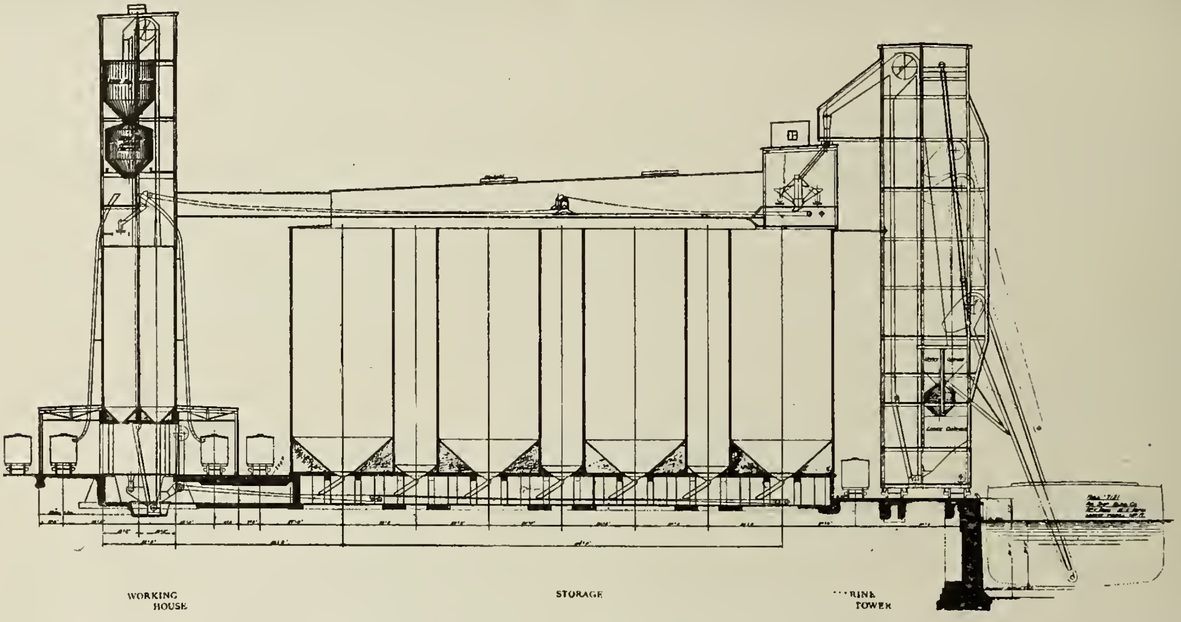


Fig. 14—The St. John work two weeks later.

sideways, and it was found that the 6 x 6 posts would not stand. The posts were, therefore, taken out and 8 x 8 posts substituted. These also did not stand the strain. The owner was advised to take the posts out and there was no more trouble. The action is very simple. When the hole in the left-hand side was opened the grain coming across pushed over the posts, and instead of the posts helping the rods they pulled them down.

The building of the bins is probably the most interesting feature in the construction of a grain elevator. It was the feature which required the most careful consideration when the change from the wooden house to the concrete elevator took place.

Figs. 3 and 4 are illustrations of the manner in which an elevator is being built at the present time in Manchester, England. The bins are of concrete, rectangular in plan, and about 70 feet deep, some kind of a shutter form being used. The reinforcing is both vertical and horizontal, and the vertical reinforcing is spaced so closely that looking at the picture it would appear almost impossible for the workmen to get from one part to another. The progress on this work is about 18 inches vertical, per week, and at this rate it will take eleven months to put up the bin walls.



General cross section, C. P. R. elevator at Victoria Harbor, Ont.

Fig. 5 illustrates how elevator building is done on this side of the water. It is a picture of the forms for some bins erected at Fort William. The bins are circular in plan, the cylinders being placed in contact with each other, and the small spaces between the cylinders being used for storage of grain. On this form a man may walk anywhere over the entire area covered by the structure, and may wheel concrete and deposit it in any of these walls directly from buggies. The moving form, about four feet deep, goes around the outside and inside of the bin walls and is held together by yokes of some kind that span the wall above the level of the form proper. A jacking device is attached to the form so that it can be lifted up as the work progresses. The concrete is poured into the form and the form moved up continuously. This part of the work may be executed in different ways. Some use a plain round rod with a jack that clamps the rod, and the form simply climbs up on the rod leaving the rod in the wall. On the forms shown in the illustration, rods threaded the entire length were used with an ordinary nut and nut holder, with means to turn the nuts so as to lift the form as the work progressed.

Fig. 6 is a view looking out over the top of the forms at Port McNicoll; the bins are thirty-three feet in diameter with walls eight inches thick.

Fig. 7 is the same work viewed from the other side of the slip, showing the forms part way up. The first section of the building is shown to the right. The second section was put up last summer. The illustration shows the arrangement for conveying the material over to two towers, from which it was spouted out to carts and distributed over the area.

Fig. 8 is a picture of the same set of bins after the forms had been removed and the steel work was being erected on top of them. These bins hold in the neighborhood of forty-eight thousand bushels of wheat each.

Fig. 9 shows some forms being erected in Montreal harbour for Elevator No. I. These forms were run up ninety-six feet in fifteen days, about six feet four inches a day. The distance that a moving form may be raised, or the amount of a bin wall that can be built in a day, depends on a great many elements. For instance, if the building under construction is very large, the difficulty of getting a sufficient amount of material on the work in twenty-four hours is probably the controlling feature. When the building is not very large, the rapidity with which the material will set up is the controlling feature. In warm weather, with a small job, it is possible to put in over ten feet a day. This summer at Lawrenceburg, Ind., on a small building, the walls were run up ten feet five inches in twenty-four hours. That is going just a little too fast because there is danger of the concrete falling out of the forms at the bottom. Six feet can be put in with safety in warm weather, and, in cold weather, the progress must be much slower. The bottoms of the forms should be watched to see that the concrete is setting up sufficiently to sustain the load above it.

Fig. 10 is another view of the Harbour Elevator No. 1, showing the height to which the forms had been raised in just one week's work. The dark line indi-

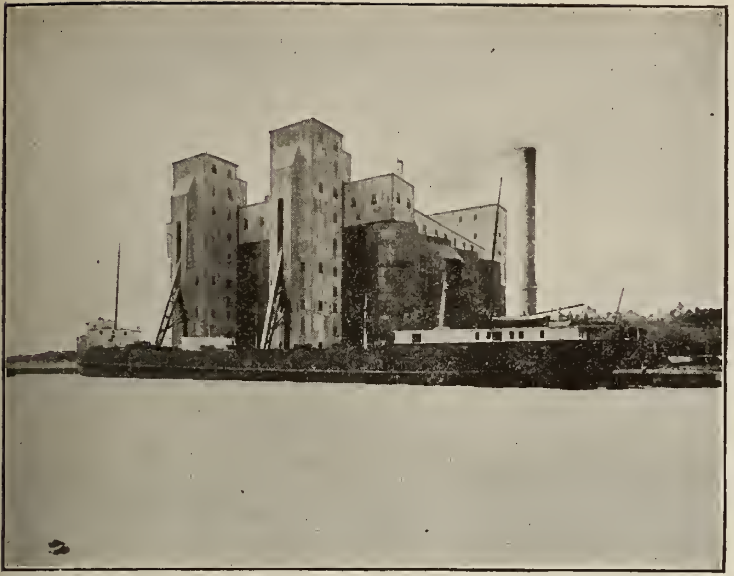


Fig. 16—An elevator at Tiffin, Ont. Note the marine towers.

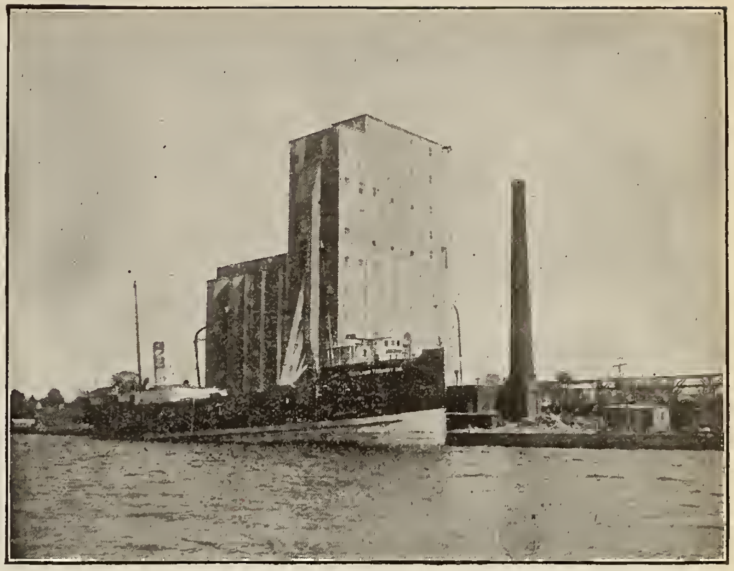


Fig. 17—Concrete elevator at Ogdensburg, N. Y.

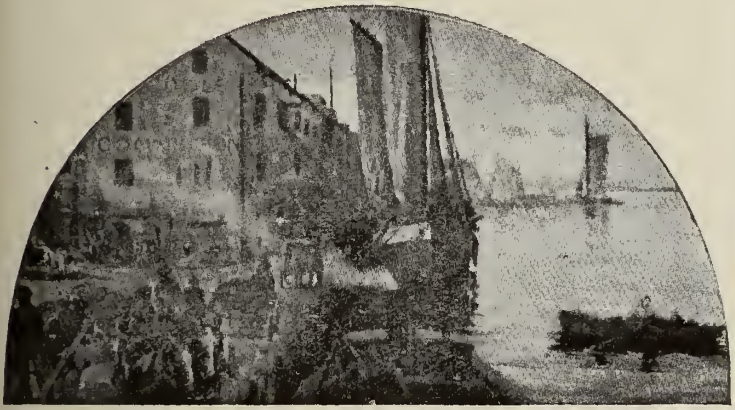


Fig. 15—Chicago's first grain elevator, built in 1838.

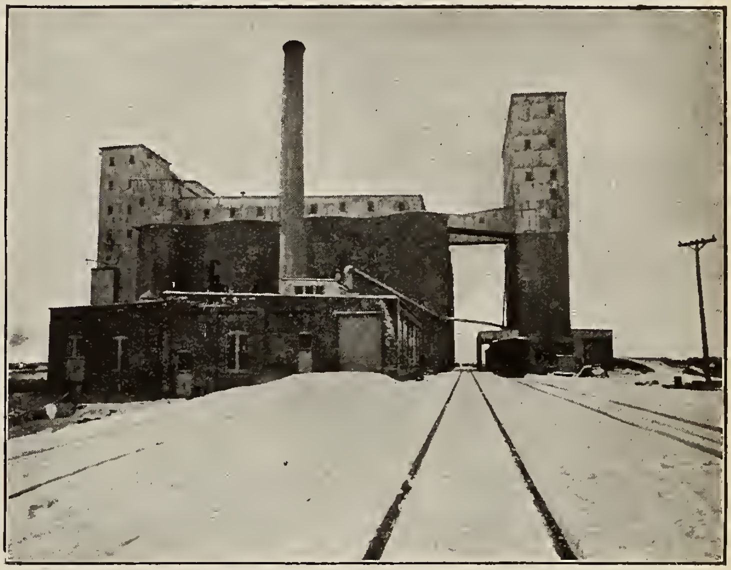


Fig. 18—Elevator building at Port McNicoll.

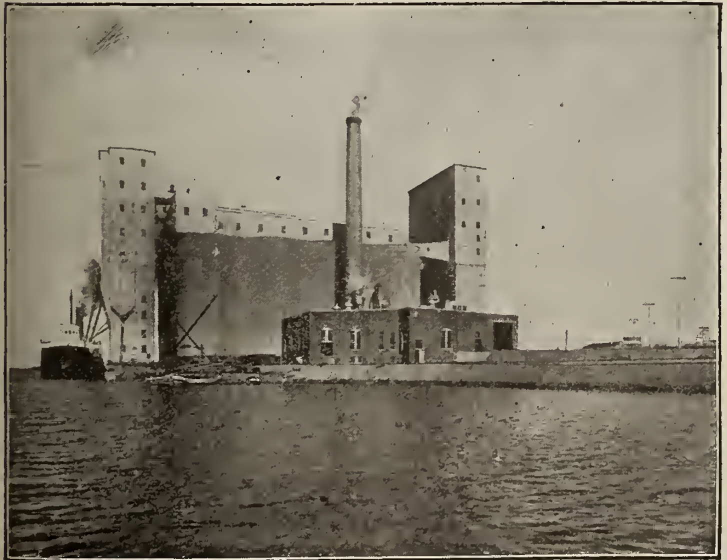


Fig. 19—Another view of the Port McNicoll building.

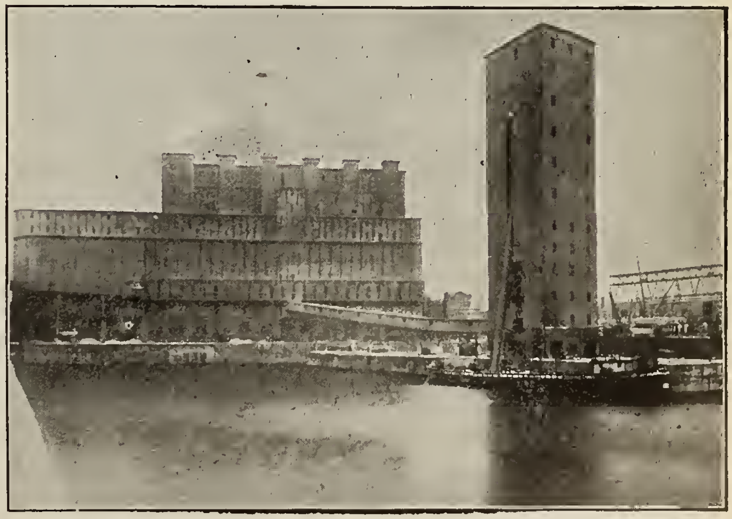


Fig. 20—Montreal Harbor Elevator No. 2. Capacity two and one-half million bushels. The largest concrete building of its kind in the world.

cates that this material was not set up very hard. It dries out on one side faster than on the other, probably depending on exposures to the sun.

Fig. 11 shows the same work two weeks later, with the forms removed from the top of the bins and about ready for the steel.

Fig. 12 is a view at the other end of Elevator No. 1, showing eighteen bins on the land side. The scaffold shown below the form is for the men to go around and point up any defects which may appear in the wall as soon as the wall is uncovered by the gradual upward movement of the forms. One of the difficulties in building in a location such as that shown in the picture is due to the restricted space and absence of any place in which to store a large amount of material so that a number of bins can be built at one time. The reason for cutting this particular work in two and building one part first and then the other was that it was impossible to get enough material on the ground to build everything at once.

Fig. 13 is another view of the same kind of building at St. John, N.B. This particular picture was taken on June 18th, four days after the moving forms were started, and two weeks later (Fig. 14) the building was seventy feet high. It went up fifty-three feet in two weeks. One of the troubles was to get enough material to keep the work going as fast as was otherwise possible.

A word should be said about the marine towers shown in Fig. 16, which is an elevator at Tiffin, Ont. These towers are 28 x 32 feet and 150 feet high. They run on two tracks and have a mechanism to propel them along the wharf. Each tower is supported by forty car wheels and weighs about 650 tons,—quite a bulky thing to move around. It is moved longitudinally in order that it may get into various hatches and holds of vessels, so that if one tower gets through its work ahead of another it can move to another hatch. One of the principal troubles with the tower is to hold it against the wind pressure, which is quite great on a structure so high. The tower is held back to the storage building by a travelling guide which is about thirty feet long. These towers are supplied, at intervals along the wharf, with various places at which to lock in case of storms, and have a propelling mechanism which will take them against a ten pound wind; if the wind is stronger than that the towers have to remain in one place. A tower of this kind is also supplied with mechanism to raise, lower and place the marine leg in any position in the hold of a boat. This marine leg is eighty feet long and weighs with its boom, thirty-one tons. Power to operate the ship and clean-up shovels is supplied from the tower, and the grain is weighed in the tower as it is received.

The first grain elevator in Chicago, built in 1838, is shown in Fig. 15. It was simply an old warehouse, with an elevator leg put in it, a belt with buckets on it, and at the top one horse-power (literally, as a horse on a treadmill furnished power) which elevated grain to the top of the building where it was spouted on to the floor. Holes were cut in the floors to let the grain fall down on to the next storey. The spouts leading out to the vessels show that grain was then carried in bulk instead of in sacks. Quite a number of old buildings were used in that way. In one case an old dwelling house in St. Louis was used to store grain. The building stood while it was filled, but when the grain was being drawn off in the spring, it collapsed.

Fig. 17 is the picture of a concrete elevator at Ogdensburg, The only peculiarity about it is that the marine tower shown on the side was built with a moving form, and put up at the same time that the bin wall was constructed. It was a pretty piece of work and very expensive.

Figs. 18 and 19 show the complete house at Victoria Harbour, Port McNicoll, including the power plant and the concrete stack. This concrete stack has no cracks in it. One was built before that had a great many cracks, the reason being that there was not enough concrete in the stack. It was erected by a stack builder who prior to making the specifications had examined a large number of stacks and found that they were all more or less cracked. The theory upon which these stacks were built was that enough steel was put in them to take the tension and enough concrete to take the compression. As a matter of fact, in building a concrete stack enough steel should be put in to take the tension if the concrete cracks, and then enough concrete to take the tension anyway. At least the tension on the combined section of the concrete and steel should be low enough to prevent the concrete from cracking. The walls of a concrete stack would, under these conditions, be twice as thick as those made by the ordinary stack builder.

Fig. 20 is a picture of Harbour Elevator No. 2, Montreal, an elevator of two and a half million bushels capacity, all concrete; in fact, the largest all concrete building in the world. It required 44,000 yards of concrete and 2,900 tons of reinforcing steel. It has an unloading capacity from cars of about 250 cars in ten hours, 40,000 bushels per hour from boats with its two marine legs, one on each side of the tower shown in the foreground, a shipping capacity of 90,000 bushels per hour to boats, and is an entirely up-to-date house. This elevator, with the Windmill Point and Harbour Commissioners No. 1 Elevator and their shipping galleries, makes Montreal the best equipped ocean grain harbour in the world. The equipment, however, is not sufficient for the demands of the port.

Quality in Concrete Mixing

THE contractor who is contemplating the purchase of a concrete mixer naturally looks for quality before buying. Mixer quality means a combination of many good things, and to have true quality a mixer must possess at least the following characteristics:

(1) It must be designed to operate according to the correct mixing principle, for perfect mixing is governed by a scientific principle, just as is every other mechanical operation.

(2) It must be well constructed; that is, good materials and good workmanship must be employed in its manufacture.

(3) It must have capacity; that is, its body must have large volume in proportion to the space it occupies; and its speed of full-volume output must be rapid.

(4) Its total output life must be long; that is, that volume of concrete which it will mix before being worn out must be large.

(5) Its delay losses must be small; that is, interruption of working time for making repairs or due to any defect of the mixer itself must be a minimum.

(6) It must be manageable; that is, all operating functions must be capable of perfect control as to time, amount, and place.—Cement World.

Cost Accounting and Its Importance on Construction Work

By Leslie H. Allen.

THE problem of cost accounting on construction work is one that has not received the amount of attention and study that its importance warrants. When we consider the vital importance to the contractor on construction work of a knowledge of the cost of his work, it is surprising to find that only a few contractors have succeeded in finding out in detail what the unit costs of their work are. Most of the big commercial enterprises make a point of figuring very carefully their cost of production, but building and engineering contractors seem content to go on in their old ways, with only a hazy idea how their work is coming out, and no definite knowledge as to the amount of profit or loss made until the job is completely finished and paid for. Mr. Sanford Thompson, in his book "Concrete Costs," asserts that "as generally practised, cost keeping is so approximate and inaccurate as to be of comparatively little value for estimating or for immediate use," and later on he states that estimates of labour costs are frequently mere guesses, because the contractor does not know with any degree of accuracy the time and cost of doing each kind of work." I venture to assert that not more than 10 per cent. of the contractors in Boston doing work on a lump-sum basis could tell within one thousand dollars what their profits or losses are on their unfinished contracts now in hand.

It is not hard to find a reason for this state of affairs. The old-time superintendent of construction was usually a mechanic who by reason of special ability had risen to the command of men and become a superintendent. These men, of whom many are still with us (and doing excellent work), are men to whom figures and costs meant very little. They relied for success on their innate common sense and their ability to drive the men under them, and although they made mistakes, some of which would have been self-evident if they had studied costs carefully, yet they did excellent work and achieved results not to be despised even in these days of scientific management, cost accounting, and complex organizations of one sort or another. Such men, however, took no interest in cost accounting, and if directed to furnish cost figures took very little care to see if they were made up rightly or not.

Another reason is that there is often a lack of definite instruction given from the office as to how costs are to be kept, and that no man who has studied the problem and knows definitely just what is wanted is in charge of the work and personally responsible for it. The timekeeper on a construction job is a very busy man. Often he has materials to order and check, and many other duties to perform, and has no time to think out the details of a cost-accounting system for himself, and he contents himself with as little work in subdivision of payrolls as his experience tells him will "get by." Then when his reports come in they are handled by clerks who do not understand them and who do not make any effort to correct them as they go through, and the cost-accounting system becomes unreliable and one is told that "it is impossible to keep accurate costs on construction work."

It is probably true that every contractor and builder has made some attempt to find out the unit costs of the work he does. Some contractors have got a system that really gives them the information they need. Many firms have a cost-keeping system which tells them approximately what their unit labour costs from week to week are, but takes no account of materials and gives them no idea as to how the whole job stands financially. Such men have no real idea as to whether their jobs are profitable or not until the bookkeeper's statement at the close of each job shows the actual profit or loss made. Many have tried to keep up a cost-keeping system, but have thrown it up owing to its difficulties and inaccuracies, and rely simply on their bookkeepers to tell them how much expense has been incurred on the job, while their eye tells them how much of the job is done. The author remembers in his earlier days being directed to visit half-completed jobs for which he had made the estimate and make a survey of same for comparison with the bookkeeper's statements, and this was the only way known by his firm at that time of comparing estimated costs with actual costs to see what profit or loss had been made, although at that time a system of reporting weekly costs was being used similar to that outlined above.

With the change of the times and the change in contractors' methods the attitude of the contractor to cost-accounting systems is changing too. The old-time superintendent is giving place to the technical graduate who is a man with engineering training accustomed to view the situation from all sides and relying on actual cost figures rather than on his own judgment to tell whether his work is efficient. Modern competition is becoming so keen and work is taken on such a small margin of profit that it is of vital importance that every item of the work be kept down to its estimated cost, and cost keeping is fast becoming a necessity to all who wish to make a profit out of contracting on construction work.

The purpose of any cost-accounting system is threefold. First, to watch the job from week to week to see if the work is being carried out economically; second, to see whether the cost is above or below that of the original estimate; and third, to furnish information for future use in estimating and in supervising work in progress. In other words, first, to determine the items of prime cost and the unit prices of these items; second, to discover what relation these bear to a predetermined selling price; third, to establish new selling prices for future work. The relative importance of these three items is in the order given.

The problem before the contractor's accountant is an entirely different one from that of the bookkeeper or the factory cost-keeper. A good deal of the dissatisfaction and incompleteness of many existing systems is because the problem has been approached from the financial point of view rather than the engineer's. I think it was Mr. R. T. Dana who was the first to insist that cost keeping was not a bookkeeper's job and could not be satisfactorily handled by the man who kept the firm's books. This is so. The bookkeeper's viewpoint is the financial one, and deals with totals and balances of cash. The cost accountant's viewpoint is an engineer's, and deals with unit costs and quantities of materials. The two cannot be satisfactorily held by one man unless he has had a thorough training both in bookkeeping and engineering lines. Such a training is rare. The primary object of the cost-keeper in a large factory or mill is to determine the selling cost of the articles, and therefore every item of expense burden incurred in carrying on the factory is prorated or apportioned to the cost of the articles produced for sale. The contractor's selling cost is determined beforehand and he is faced with the problem of so splitting up his selling cost that he has a proper appropriation for each item of expense, the very reverse of the factory's accountant's problem. It is for this reason that I have placed prime cost first as being the most important, and selling cost last as of least importance.

The estimate of cost on which a contract is taken is more like the Budget appropriation of our Government, which, having a predetermined amount of money to spend, proceeds to allot as much as is possible to each Government department in proportion to its needs, the total of such appropriations being equal to the amount of the estimate of cost.

The contractor's cost accounts, if they are to be of any use, must show not only the amount of money spent in the work, but the way in which it has been spent, and this cannot be shown if items of general expense, such as plant, watchmen, etc., are all distributed among the items of excavation or concrete. The result may be financially accurate but uninforming to the contractor. For instance, on the cost accounts on the Panama Canal, cost of plant, track, forms, and general expense, etc., all are worked out in terms of per cubic yard of concrete. This is correct from the financial viewpoint, and the result shows the cost of the concrete to the Government. But it does not tell an engineer whether the work is being done efficiently or not. He wants to know the cost of setting up and repairing the plant, the cost of handling the material, the detailed cost of form work, while general expense is meaningless to him unless he knows the details. When the cost of moving tracks, repairing plant, etc., is reported at so much per cubic yard as a subdivision of excavating cost, the cost of the operation cannot be criticised. It is very necessary that this distinction be kept in mind and that costs should be worked out from an engineer's standpoint rather than from a bookeeper's or an accountant's standpoint. The information turned out by the cost-accounting department should not only show results but should give information showing the reason why the results are so.

In the author's judgment, the cost accounting on construction work should be handled in connection with the estimating department rather than in connection with the bookkeeping department. The estimator should know best what information he requires from a job to check up the work he has estimated, and into what units the costs should be divided. He is then enabled to keep closely in touch with actual work in progress and compare with his estimate from time to time.

The method usually employed by contractors in their cost accounting is to divide up the time spent on the job under certain fixed headings, such as excavation, brickwork, mason work, concrete work, carpentry, and so on, and to make a report of the quantity of each kind of work executed, and to work out from same either daily or weekly the unit labour costs; at the close of the job, to work these up into totals and also to work up at this time the cost of all materials into units and combine them with the labour costs, giving the total cost of labour and material on each item of the work. This works well in some offices as far as it goes, and shows whether each week's work was efficient and economical. But if no account is kept of material until the job is closed, and no check is taken on quantities reported by the men on the job, and no comparison is made with the estimate, its value is not very great. In the system used by the Aberthaw Construction Company, we have added from time to time the following features which do not appear in most accounting systems. First, in addition to the weekly labour costs, the average labour cost on each item to date is figured. Second, a periodical check on the quantity report is made. Third, we use a standard mnemonic code revised to suit the requirements of each job. Fourth, an accounting of material is kept up from month to month. Fifth, an analysis of the estimate is made for comparison with the weekly costs. Sixth, a monthly balance is struck, showing profit or loss to date. Seventh, a "field sheet' is furnished to the timekeeper, which enables him to keep track more regularly and systematically of the men at work.

It is the purpose of this paper to describe the Aberthaw Company's system in detail, taking up in logical order the above points and matters incidental thereto. The present system was not invented in a day, but has been a gradual development. The cost-keeping system was installed early in the history of the company by Mr. Wason, the president of the company, who laid work out upon the usual lines adopted by other contractors as indicated above. The above additional features have been added since the beginning of 1910 in the order indicated above, and the complete system may be said to have been in working order for over two years, long enough for us properly to try it out and to know that it really gives us the information we need. In other words, the system I am about to describe is not the dream of a theorist, but something that is really practicable; that is not expensive in operation and that any contractor can use if he has but the patience to study his problem and insist on getting just the results he wants.

Although the author's firm specialises in one branch of construction work, the system is equally applicable to any other work of similar nature, whether in the line of heavy engineering or the building of modern office buildings or frame dwelling-houses.

All metal which has been bent or otherwise injured in handling or in transit should be carefully repaired before being used. Reinforcing bars must be straight and free from flaws in any degree calculated to impair their strength.

While a piece of lift machinery weighing 3,275 lbs. was being hoisted in a building at El Paso, Texas, it fell upon a reinforced concrete floor slab 5½ ins. thick. As the height of the fall was 85 ft., it is not surprising that a hole was made in the concrete, but the reinforcement remained intact and sustained the machinery at about 12 ins. below floor level. Practically no damage was done to the adjacent floor beam.

Concrete Highway Construction at Montreal

THE Canada Cement Company, Limited, have just completed at their No. 1 plant, nine miles east of the centre of Montreal, a concrete road which has some interesting features. The road was built to provide a permanent highway from the main road—Notre Dame Street—to the entrance to the plant for shipping by truck to the city.

In general, the standard specifications for concrete roads were followed. The actual construction was done by the Sicily Asphaltum Paving Company, Limited, of Montreal, under the supervision of the Canada Cement Company, Limited. The road is divided into 15 sections, the details of which are given later. In some sections eight pounds of high calcium hydrated lime were added to each bag of cement and the two thoroughly mixed before placing in the concrete mixer. In the one-course sections containing lime, the lime was used throughout the entire thickness, but in two-course sections the lime was used in the top course only.

Reinforcing consisted of two kinds—American Steel & Wire Company's No. 7 and No. 28 triangular mesh, and Clinton Electrically Welded Wire 5-in. x 9-in. mesh No. 12 wires, and 4-in. x 12-in. mesh No. 8 and No. 10 wires respectively. The reinforcing was cut into sheets 13 ft. 6 in. long, which were placed transversely 2 inches below the surface. All sections of the road are 20 feet wide—concrete 14 feet and shoulders of broken stone 3 feet. on each side. The shoulders are thoroughly compacted, and are given a transverse slope away from the concrete of 1½ in. for each foot of width. A 4-inch tile drain was placed under the north shoulder from Sta. 7 + 70 in Section 5 to Sta. 26 + 07, the mill end of the road. The bottom of the drain is 24 inches below the sub-grade and the trench re-filled with broken stone. The surface water is taken care of by a ditch along the south side of the roadway.

The proportions used for one-course concrete were 1:1½:3. For two-course concrete the proportions for the base were 1:2½:5 and for the wearing course 1:1:1½. The sub-grade was rolled the entire width of 20 feet. The concrete is 6 inches thick at the sides and 8 inches thick at the centre for all sections. In two-course sections the wearing course has a uniform thickness of 2 inches. The crown of the roadway has a rise of two inches at the centre, the section of the surface perpendicular to the centre of the road being the arc of a circle.

The surface of the pavement was sprayed with water as soon as the concrete was sufficiently hardened to prevent pitting. It was then covered with a layer of earth at least two inches thick which was kept moist for about ten days, after which this earth covering was removed.

Joints made of two thicknesses of three-ply tarred felt, were placed approximately 30 feet apart from Sta. 0 + 00 (at Notre Dame Street) to Sta. 3 + 13 in Sections 1, 2, 3, and 4. No joints were allowed in Sections 5 to 8 and 9 to 15 inclusive. In these sections the reinforcing is continuous between successive days' work. At the end of each day's work the concrete was finished with a vertical face.

The details of the sections are as follows:

Section 1.—Length 115 feet (Sta. 0 + 00 to 1 + 15). One-course concrete with lime.

Section 2.—Length 37 feet (Sta. 1 + 15 to Sta. 1 + 52). One-course concrete.

Section 3.—Length 96 feet (Sta. 1 + 52 to Sta. 2 + 48). One-course concrete reinforced with 4-in. x 12-in. Clinton wire.

Concrete road at No. 1 plant, Canada Cement Company, Limited, Montreal.

Section 4.—Length 65 feet (Sta. 2 + 48 to Sta. 3 + 13). One-course concrete reinforced with 5-in. x 9-in. Clinton wire.

Section 5.—Length 394 feet (Sta. 3 + 92 to Sta. 7 + 86). Two-course concrete reinforced with 5-in. x 9-in. Clinton wire.

Section 6.—Length 93 feet (Sta. 7 + 86 to Sta. 8 + 79). Two-course concrete reinforced with No. 7 triangular mesh.

Section 7.—Length 237 feet (Sta. 8 + 79 to St. 11 + 16). Two-course concrete with lime reinforced with No. 7 Triangular mesh.

Section 8.—Length 253 feet (Sta. 11 + 16 to Sta. 13 + 69). Two-course concrete with lime reinforced with 5-in. x 9-in. Clinton wire.

Section 9.—Length 19 feet (Sta. 13 + 87 to Cta. 14 + 06). One-course concrete reinforced with No. 7 Triangular mesh.

Section 10.—Length 226 feet (Sta. 14 + 06 to Sta. 16 + 32). One-course concrete reinforced with 4-in. x 12-in. Clinton wire.

Section 11.—Length 245 feet (Sta. 16 + 32 to Sta.

18 + 77). One-course concrete reinforced with No. 28 Triangular mesh.

Section 12.—Length 118 feet (Sta. 18 + 77 to Sta. 19 + 95). One-course concrete reinforced with No. 8 Triangular mesh.

Section 13.—Length 122 feet (Sta. 19 + 95 to Sta. 21 + 17). One-course concrete with lime reinforced with No. 7 Triangular mesh.

Section 14.—Length 244 feet (Sta. 21 + 17 to Sta. 23 + 61). One-course concrete with lime reinforced with No. 28 Triangular mesh.

Section 15.—Length 246 feet (Sta. 23 + 61 to Sta. 26 + 07). One-course concrete with lime reinforced with 4-in. x 12-in. Clinton wire.

Some Waterworks Engineering Mistakes*

IN 1895 it became necessary for the Peoria Water Works Company, of which the writer was then Engineer and Superintendent, to increase its water supply, and to do so rapidly. This plant included, among other items, an open well, 11 ft. inside diam. In the construction of this wall the earth was first excavated as far as the ground water would permit, and a cast iron well shoe, built of circular segments, was bolted together, and on top of this well shoe were bolted segments of oak designed to widen the shoe and to serve as a foundation for the brick masonry wall of the well. Excavation was started inside of the well shoe, the masonry wall being built up on top of these wooden segments as the well sunk. It was the intention to sink this well to bed rock, seal the bottom with concrete so as to make a watertight pit, and then drive out push wells through apertures in the wall.

The writer, however, made the mistake of pumping from the inside of this well, part of the material being removed by the pumps and part by buckets which were filled by men standing on the bottom. The well sank rapidly from 2 to 3 ft. a day until within 12 ft. of bed rock, when its progress was suddenly diminished and all efforts failed to get more than 4 ft. further. It was found that at about 8 ft. from bed rock the sand ran in under the shoe as fast as it could be removed.

An effort was then made to sink a steel ring 10 ft. in diameter by 5 ft. high by ½ in. thick on the inside of the well in the hope that this could be sent down to bed rock; but after much time had been lost in trying to keep ahead of the incoming sand, the attempt was abandoned. Oak wedges were then driven so as to close solidly the space between the ring and the wall of the well, and four 6-in. driven wells were sunk to bed rock. Four 6-in. push wells were also driven out through holes in the wall of the well, and all eight of these 6-in. wells were connected up to the centrifugal pumps and the plant was finally put in operation. It has been operated successfully, whenever required, during the past 19 years.

The reason why it was impossible to sink this well any further was that as the well approached the bed rock, the area of the belt of water bearing sand through which the water had to pass in order to reach the pump, was constantly growing less. At the same time the rate of pumping was constantly increasing. Consequently, when the point was reached at which the velocity of the inrushing water became so great that it dragged in the sand, this sand simply continued to run in as fast as it was removed, and the well naturally could sink no further.

On looking back at the work, this explanation of the trouble seems so simple and natural that the writer has wondered many times why he did not foresee the difficulty; but he has since seen the same mistake made so often by others that he feels encouraged to hope that this description of his own experience may prevent someone else from going wrong in the same direction. In his own practice, the lesson has been of much service, for it has led to the construction of a number of wells, in the design of which special attention was paid to the matter of preventing the inflow of sand, not only during the process of sinking the well, but also after the well has been finished and put in operation.

The particular well first described could have been sunk to bed rock at much less cost, either by the pneumatic process, or by excavating from the inside with orange peel bucket without pumping, or by sinking other wells outside of the large well and pumping from these to lower the water in the large well. As the sand was removed, the well would have sunk, provided the weight of the well were sufficient to overcome the skin friction. No more sand would have run into the well because of the fact that the water would have had no velocity to cause the sand to flow.

This mistake of the writer was at the time an expensive one for his client; but he has the satisfaction of knowing that the extra cost of this well was saved many times thereafter in other wells sunk in better fashion for the same client.

The writer made another mistake in connection with this same piece of work. The water furnished by the supplemental well was brought down by gravity to the main well, some 3,300 ft. away. For conveying this water, a 24-in. vitrified tile pipe was built. It was hoped that this tile pipe would cost much less than a cast iron pipe, and it was believed that the tile pipe could be made practically watertight. Tests of the watertightness of this pipe were described in a paper read before the Illinois Society of Engineers and Surveyors, in January, 1896.

The attempt to make the pipe practically tight was successful, but the expense was so great that the writer can now see that he should have made this pipe of cast iron instead of tile, for much of the pipe had to be laid in quicksand, and where a great deal of groundwater had to be taken care of, making it very difficult and expensive to make full cement joints in the tile, and to hold the pipe and the joint in place until the cement had set. Under these conditions, cast iron pipe would have actually cost less, laid in place, than the tile pipe.

Tile pipe has since been so often used for watertight work instead of cast iron, and so often with disappointing results, that it is hoped that a recital of the foregoing mistake may prove of service to others.

A third mistake entered into the design of a small water works, built about 20 years ago, and the writer's first complete water works installation.

This plant included an elevated tower and steel tank of about 60,000 gals. capacity, and for every part of that structure detailed working drawings were prepared. With the desire for originality too often displayed by young men, inventors, and others lacking the wisdom of practical experience, considerable pains were taken to design connections which were novel. It is safe to say that the like of some of these connections has never been seen in any other structure, before or since.

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* By D. H. Maury, in Engineering and Contracting.

The working out of all of these details not only multiplied the time required for the design of the structure by three or four, but the novelty of the connections also added several hundred dollars to the contract price, for the bidders could not use their standard shop connections, but were compelled to figure on the writer's more expensive and less practical designs.

The tank still stands, and a recent inspection showed it to be in first-class condition. The total compensation received by the writer for his services in connection with this early job was so small that his conscience troubles him somewhat less than it otherwise would; but whenever he passes that way he views that tank from the train window with mingled emotions.

The lesson to be learned from this last mistake is that no engineer, if he has his client's interests at heart, can afford to overlook the contractor's viewpoint when he prepares his specifications.

Contractors must be expert in the practical details of construction, and especially in cheapening construction costs, or they cannot continue in business. If the young engineer wishes to learn more about these matters than he has ever learned before in the same length of time, let him, after he has prepared a rough draft of his plans and specifications, discuss these with a few of the more trustworthy and experienced contractors who are likely to bid on the work, and he will be astonished to find how many changes he can make to his client's advantage, without in any way impairing the design of the work or the validity of the contract.

If the young man will then not let his exalted ideas of his dignity as an engineer prevent him from accepting suggestions of the contractors, he will show that he is worthy to receive much of the success which is almost sure to crown his future efforts.

The Engineer and the Contractor—Their Relation on the Job

THE engineer or architect is able to plan great structures and large engineering schemes, but when it comes to the erection of these structures or the methods adopted in carrying out these engineering feats to successful conclusion, this work usually devolves upon the contractor.

The contractor occupies a peculiar position in that, to be successful, he has to be possessed of a temperament and faculties not required in the average profession. I mean that the successful contractor meets and has to contend with, more obstacles in his work, than falls to the lot of the average business man or merchant, and in addition he has to be able to manage and direct his office affairs and the work of his employees in such a way that for every dollar spent on his work he hopes to receive more than one hundred cents in return.

The engineer has a great many advantages in planning a great enterprise over that enjoyed by the contractor; usually he is not limited in the time taken in drawing his plans and specifications, and has ample opportunity to investigate all conditions and make researches prior to the time when bids are called for, but the time usually allotted to the contractor for preparation of this bid is usually very short, and often a sufficient period is not allowed him for investigation of conditions, etc., source of supply of labor and material, and other important considerations which go to make up the bids prior to the opening of the same.

It has been said, and truthfully so, that a successful contractor must have three qualifications, first, Faith; second, Hope; and third, Nerve, and of these three virtues (if they may be so termed), it seems to me the latter is the most important.

First, contractors as a general rule usually know the men at the head of all large engineering schemes, upon which they bid and have faith in their judgment, and accept without question their plans and specifications as being correct, and the result of months and probably years of study, and rely in a great measure upon their judgment.

Second, they hope in event of securing a contract, to be favored with such conditions when the work is under way, as will enable them to make money legitimately, because you will find that the average contractor doing business to-day, is honest, and he takes a certain amount of pride in his work (although in this, as in all cases, there are exceptions to the general rule), and he hopes when certain conditions and questions arise, during the progress of the work, and the matter under discussion put up to the Chief Engineer or other official in authority, that he will be big and broad enough to look at the situation from the contractor's standpoint, as well as from the viewpoint of the municipality or corporation by whom he is employed.

Third, to undertake large contract work requires considerable nerve, because usually if conditions are favorable and the prices at which the contract has been secured are reasonable, and the specifications liberally construed by fairminded engineers the contractor sometimes makes money, but ofttimes when unforeseen conditions arise during the progress of the work, materials and labor advance, extremely rigid and arbitrary interpretations are given to the specifications, impractical and unreasonable inspectors placed on the work, and various other obstructions put in the contractor's way (sometimes by those directly interested in the contract, and at other times by disinterested parties), it requires considerable nerve on the part of any man to continue the business of contracting in order to make a living.

Practically all recent works of great magnitude have been let by contract, with one exception, that being the Panama Canal, which is being built by the Government, under the supervision of army engineers who had practically an unlimited amount of money at their disposal, and who were not hindered in any way in the expenditure thereof; their motto being, "Build the Canal, build it well, and at any cost."

Great works like the increased water supply for New York City, the New York Barge Canal, the reclaiming of millions of acres of land in the west, the improvement of our rivers and harbors, and even down to our own local improvement, such as the water supply, the building of our sewers, paving of the streets, covering of the falls, building of the docks, extensions of parks, improvement in terminal facilities of the various railroads leading into the city, the improvement of our State highway system, erection of municipal buildings, etc., have all been let by contract, for the reason, no doubt, that those in authority recognize that where possible, it is much better to have the work done by this method than under the day labor system.

The work is done as well under the contract system as if it is performed by day's work, and ofttimes better, because on day labor work done by a State, municipality or corporation, usually there are no rigid specifications in effect and practically no inspections (except when the engineer happens to be on the work) and many things are done, which would not be tolerated for a moment if the work was being done under contract; furthermore, the engineer on contract work has less worry (this being shifted to the contractor's shoulders), and the last, but not least reason is that it is almost universally conceded that work done by contract is done far cheaper than if performed by the day labor method.

A prominent engineer once told me that "specifications were only made for rouges and thieves, that honest men did not need any specifications"; he meant this, however, to be interpreted in a broad way.

I do not fully agree with him in his statement, because I believe that short specifications clearly written and impartially enforced are a benefit to both the municipality or corporation and the contractor.

The clauses in a set of specifications as written by the average engineer are not always clear and intelligible to the average contractor, and anyone who engages in contracting work now, if he wants to be "up-to-date" should take a course in law also, so as to be able to reason out the intent of some engineers who write specifications, because some specifications of to-day if literally construed as written, could place an average contractor in receivers' hands in a short time, unless he had an unlimited amount of money at his disposal.

Take the usual set of specifications as issued to-day for public work to reputable attorneys and ask them to give you an unbiased opinion of its contents and ninety-nine out of one hundred will tell you that you would be foolish to sign a contract with such clauses incorporated therein, because it is so written to provide all the safeguards possible for the municipality and to place the responsibility for everything that may happen, even including the acts of Providence upon the contractor.

In other words, they bind the contractor hand, foot, body and soul, because some specifications have almost every possibility and condition between the heaven and earth, and even into the depths of the same covered by a clause which they can point out, which covers the disputed point when questions arise, but contractors must live, and some in their eagerness to secure work would sign any contract and specifications no matter how definite or unreasonable it was.

To my way of thinking, it is a mistake to make specifications too lengthy, but some engineers seem to think that it is absolutely necessary to have a large volume of directions written for the contractors' guidance, even though the job is a very small one. They write so much in fact, that their requirements overlap, that is the clauses contradict themselves, and in one part of the book you will find certain clauses, and by carefully reading subsequent paragraphs, you will be left in doubt as to the real intent and meaning of the one who wrote the specifications and as to how they will be enforced.

If the specifications were short and clear, that is, expressed in plain everyday language, which neither the engineer or the contractor could take advantage of (in other words the avoidance of double meaning clauses), many of the disputes which now constantly arise would be prevented.

When a dispute does arise on work, the interpretation of the particular clause in question, is usually put up to the engineer in charge of that particular section or piece work for decision, and this is where a young engineer should be given some authority.

If enough confidence is placed in a man to select him as the pilot of a particular piece of work, enough trust and authority should be placed in him to construe disputed clauses liberally when the occasion arises, and he should be given the right to settle minor questions that arise, and not be troubling his Chief with every little matter of detail, and only in case that he and the contractor cannot agree, should the question be carried to the Chief Engineer.

In ninety-nine cases out of one hundred minor disputes such as arise on contract work can be reasonably and promptly settled if all parties will meet with a feeling of friendliness and confidence, but the average young engineer knowing that he has the book of specifications to rely upon, and that they are his doctrine, and the further fact that he is in authority in so far as that particular piece of work is concerned, ofttimes looks at the clauses under discussion from a very narrow point of view, and if an appeal should be taken from his decision and carried to the Chief Engineer, ofttimes he considers it a personal reaction upon his professional ability, and although the decision of the Chief Engineer may sustain him, there is always a feeling of coolness between him and the contractor.

Whereas on the other hand if the decision of the Chief Engineer should be adverse to the younger engineer and contrary to his views already reported to his Chief and in favor of the contractor, usually he feels that a personal insult has been inflicted on him and his professional ability questioned, and I have heard of instances where the engineer resolved to "get even" and, holding the master key he sometimes is in a position to take advantage of the other, because co-operation is the key to success in all great works.

Engineers and contractors gain their experience from years of hard work; text books do not contain all the rudiments of any profession, these are secured by personal efforts, hard knocks and practical experience and a young engineer at the completion of his required course in a university is not as fully qualified to pass on all questions as one who has had years of experience, although the technical education of the latter may be somewhat limited when compared with that of the former.

Contractors usually get their experience by hard work, and ofttimes at great expense, and some reliance should be put in their judgment also; in other words, some little credit should be given a contractor who has had years of experience, for knowing a little of the work he undertakes and the best method of conducting it, because, as before stated, a contractor to be successful must adapt himself to all conditions; must have such a personality as will enable him to please and work with the engineers and at the same time look out for himself from a financial point of view, if he is to be successful.

It is sufficient to say, in conclusion; that an engineer should rely somewhat on the contractor, "give him some credit for his experience, etc.," and the same confidence should be put by the contractor in the engineer, and if they are of such temperament that they can work in harmony, disputes will not arise. When they do, they can be quickly and amicably adjusted and leave no ill feeling at their conclusion and success will be the result of their efforts—Engineering News.

The Preparation of Architectural Drawings

Some Pertinent Suggestions Regarding a Subject of Special Value to Those Engaged in the Building Business

TO those actually engaged in the building trades, more especially to the student who is studying construction in any or all its various branches, the ability to correctly read architect's drawings is of the utmost importance. In order, however, that drawings may be readily understood it is essential that they be properly and accurately prepared and in a manner wherein a recognized system of lettering, figuring and coloring has been adopted. In these few hints on the reading of architectural drawings, says a writer in a late issue of the London Building World, it is purposed to present brief points with regard to their preparation which will be appreciated by readers who are compelled to make working drawings from sketches which are in themselves incomplete. When dealing with a set of drawings it must be remembered that it is absolutely necessary to take plans, sections and elevations together as forming one scheme or idea, for what is perhaps only imperfectly expressed upon one drawing may sometimes be made quite clear on another. Should a recess be indicated on the plan it is obvious that unless a section or elevation of this detail be studied the type and the method of finish at the head cannot be ascertained, and this same principle applies throughout.

Usual Method of Procedure

The usual method employed in all offices is to prepare firstly the complete plans, sections and elevations of the whole scheme to a scale of 8 ft. to 1 in., from the approved sketch designs, and then any particular feature is detailed to a larger scale, say 2 ft. to 1 in. Subsequently full-size details are prepared of the various mouldings and features as necessary, and each detail drawing must be followed in preference to the smaller scale drawing originally prepared. Of course, it is quite usual in many cases to detail certain features at an early period to assist in the more accurate preparation of the small scale drawings. But these are merely preliminary details, and in many instances they are redrawn and properly finished up when required at a later date. Figured dimensions must always be followed in preference to dimensions scaled from a drawing, and many mistakes would be avoided in the execution of works if draftsmen would only insert more figured dimensions, as there is often great difficulty in getting drawings absolutely true to a scale when working on such materials as tracing-linen and paper, which are much affected by the variations of the atmosphere. Sizes, unless otherwise stated, are those to the face of the rough work. For instance, a measurement shown between two brick walls indicates the face of the brickwork and not the face of the plaster or other finish that may be applied. Centre lines should always be worked from, whether in preparing or reading a drawing, and by this method the job will be greatly facilitated. In outlining a roof truss the student will find it much easier if the centre lines of all the members are drawn in the first instance, and the sizes are then scaled off on either side, and in addition he will be sure of getting all the members so disposed in relation to each other that the loads will be transmitted in a perfect manner.

Working Drawings are Colored

Architectural working drawings are invariably colored, and a certain amount of system prevails with regard to the colors used for each particular material, but slight variations are made by different offices, not, however, difficult to follow when a little experience has been gained. On the plans the flooring materials are indicated by light washes, wood being shown a light brown or yellow; cement, a pale gray; tiles, light pink; marble, light green; stone, very pale blue, and granolithic, a pale mauve. Patent flooring materials are indicated by a light wash approximating to the color of the real article.

On roof plans, tiles are shown in various shades of red; asphalt is indicated by a dull brown; slates by blue or green washes; and lead by a color as nearly as possible resembling that material. It is a common practice in coloring to indicate only those materials which are actually cut by the section line, but where the surfaces in elevation are treated, light washes are applied similar to those employed on the plans, while plaster is indicated by a light green or gray.

How Materials are Indicated in Sectional Drawings

With the materials that are actually cut through by the line of section, the colors employed are invariably of a darker nature than those above mentioned, and the following are the tints generally used: Brickwork, dark red; stonework, dark blue; woodwork, dark brown; concrete, gray or fairly dark mauve; plaster, dark green; iron and steelwork, Prussian blue.

For elevation work the colors adopted are frequently selected to give good effect to the drawing, while at the same time indicating the nature of the material. Brickwork is expressed with many shades of red, one of the most successful being an orange-red, which does not entirely lose its bright effect when dry, and a little gamboge added to the color when mixed will give this result. Gauged work is usually shown by a shade of scarlet. Woodwork in elevation is usually colored a light brown (made with burnt sienna and sepia) when wrought, and a light yellow when not wrought, but frequently greens of various shades are used for effect.

Roughcast is shown in a pale yellow, or left white, and a little light shadow color is touched on in places to relieve the monotony. Stonework colors are influenced by the kind of stone indicated, the most general color being a light yellow, but such a stone as red Mansfield would be shown a dull red to distinguish same from any other stone, while granite would be shown in various shades of gray or red. Iron and steel are colored a light Prussian blue, and leadwork in a similar manner to that on plan.

Slates are shown by blue, green or gray, and tiles by a cherry-red or any shade which is in sufficient contrast to the red employed for the brickwork if the two materials appear on the same drawing. Glass is usually shown by blue or green, but a great variety of colors are used to show this material. For shading an elevation drawing a very good color can be obtained by using crimson lake and cobalt blue mixed in the correct proportions, and it must be borne in mind that atmospheric effect can only be obtained with the use of blue in some shade or other. In coloring plans and sections a very good effect is obtained if a little lampblack be mixed with every color that is used, as it has the advantage of toning them all down and making them harmonize more completely.

Black and White Work

For black and white work, where colors cannot be used to indicate the different materials employed, they are expressed when in section by means of hatching, which varies with each material, and the method is extensively used. Brickwork can be recognized by simple straight lines, placed fairly close together, and drawn at an angle of 45 deg. with the horizontal plane. Stonework is indicated by a similar method, but every alternate line is replaced by a dotted one. Woodwork is grained to imitate the annular rings. Lead is shown by lines drawn closely together at 45 deg., crossing each other at right angles, while steel is shown by a hatching of dotted lines. Concrete is expressed by small irregular shapes, intended to represent the pieces composing the aggregate, and plaster is indicated by a filling of small dots. Another kind of hatching is that of drawing lines at an angle of 45 deg., making alternate lines, thick and thin, and this method is frequently used to show wrought iron.

The Plan as a Horizontal Section of the Building

In reading the plan of a building, remember that it is really a horizontal section taken at any height required to express all the principal walls, partitions, stairs, doors, windows and fireplaces. Details which are above the line of section are frequently dotted and this method is applied to all diagrams, whether plans or sections, to show some position or form which could not actually be seen on the drawing, but which bears some definite relation to the features which are really seen. When staircases are indicated the lines on plan show the riser face, but do not include the nosing to the tread, if there be one and the width, if figured, means that which is between the wall and inside of outer string; or if free of all walls, then the distance between the two strings in the clear. Doors and windows, unless otherwise stated, are shown between the rough work, but frequently the doors are figured in the clear. Before reading a section it is advisable to look carefully at the line on which it is taken, and this will be given on the plan or plans. The direction in which the view is taken can also be ascertained by turning the plan, so that the letters or numbers indicating the section line are upright and read correctly. The heights on a section should always be figured from floor level to floor level, and not to the ceiling line, except in special cases. Sections should always be taken at points where the principal feature can be shown, such as the staircases; and it is advisable to show them taken through different parts of the building in preference to crowding detail by dotted lines.

Use of Isometric Projection

Isometric projection is a very useful method for detailing constructional work, and is much used in good-class work, where joints and similar details have to be shown. It consists of drawing all the horizontal lines of a flat diagram at an angle of 30 deg. with the horizontal plane, while the vertical lines are drawn at right angles to the same plane, and this results in a diagram which, unlike a perspective, shows the different faces of an object as they really are, and not as they would appear to the eye. Thus they can be scaled from, and all measurements are taken either vertically or on the angle of 30 deg. and none horizontally. The architect is called upon to read steelwork drawings where the steel-framed type of building is employed, and in large structures it becomes absolutely necessary for him to see that the framing is designed in such a manner that the desired architectural treatment can be obtained, while good construction is maintained.

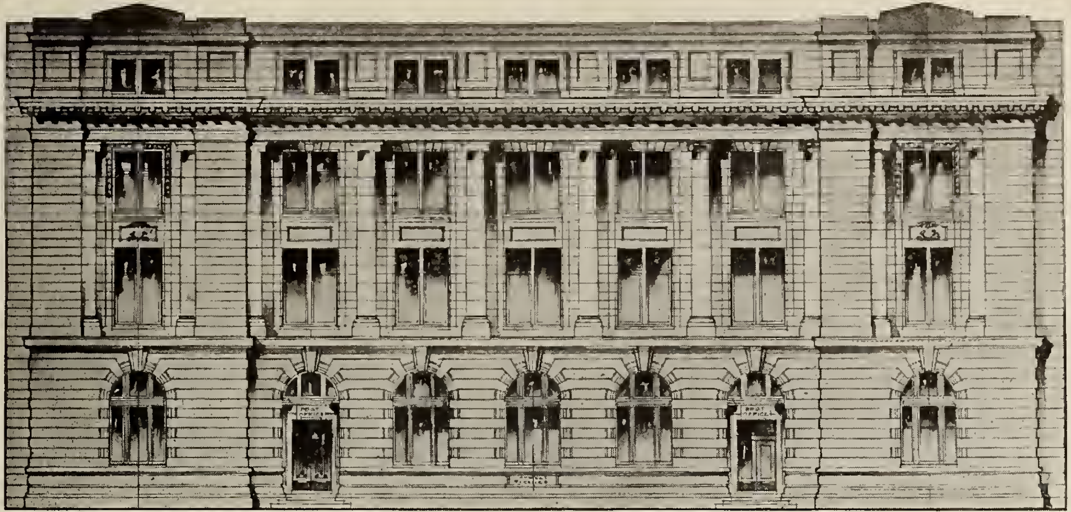
Drawings Prepared from Architects' Sketches

The majority of the drawings are prepared from the architect's sketches, and then revised to suit any alterations that may be made when the final ones are prepared. The steelwork is usually indicated by firm lines on the plan of the floor, at which level it occurs; that is, the steelwork over the ground floor and at the first floor level would be shown on the first floor plan of the building. Occasionally it is shown by dotted lines on the floor plan over which it occurs, so that the steelwork over the ground floor would be shown by dotted lines on the ground floor plan, the stanchions and supports only being indicated by solid lines on this drawing. The lines shown, of course, always indicate the centre lines of the girders and joists, and all dimensions, sizes and weights are indicated by figures, and not necessarily drawn absolutely to scale.

In reading drawings which are descriptive of the orders of architecture, students must remember that all the parts are proportioned to the diameter of the column, and therefore a scale is constructed which is composed of modules and parts, one module being equal to half the diameter of the column. Each module is divided up into thirty equal divisions, called parts, and from this scale the whole order composed of column and entablature is drawn.

The St. John, N.B., Board of Trade reports a number of enquiries from United States manufacturers looking for industrial opportunities. The opinion is expressed that our competitors on the other side of the border are already reaching out for some of the Canadian business formerly carried by Germany. In regard to the local situation, generally, it is said that public works are being pushed forward actively and that private enterprise is supplementing public effort.

Soupy concrete should be used for thin walls, but not so wet that the mortar is watery. The concrete should be puddled rather than rammed, the object being to prevent stones from collecting in any one place, and causing noticeable voids on the surface.



New Post Office at St. John, N. B.

The front elevation of the new post office at St. John, N.B., reproduced herewith, was furnished this journal by Mr. David Ewart, Chief Architect, Department of Public Works, Ottawa. From time to time we have published progress reports on this work, which is now nearing completion. The general contract was awarded in February, 1913, to Messrs. Rhodes, Curry Company, Limited, Amherst, N.S. The building is two storeys high, 200 ft. by 160 ft. in dimensions, of artificial stone construction. Mr. G. E. Fairweather, St. John, N.B., is the architect. The estimated total cost is $500,000.

Painting Concrete and Cement Surfaces

It must be understood that ordinary linseed oil paints cannot be applied with success directly to cement or concrete surfaces on account of the alkaline lime present in the cement. The action of this alkali is to burn up or destroy the oil, causing rapid fading of colored paints, and chalking and scaling off of the material. Therefore, it is necessary, if a linseed of paint is to be used, that the surface be first thoroughly saturated with a neutralizing wash that will destroy the alkali action. The most approved method is to use a solution of zinc sulphate, made by dissolving sulphate of zinc crystals in water in the proportion of 3 lbs. to a gallon of water.

A cement surface treated with this wash and allowed to dry can then be painted with any high-grade linseed oil paint without danger from alkaline action, and with the assurance that results will be lasting, as if applied to a wood surface.

Many manufacturers now put out cement paints in liquid form, ready for use, in white and all shades; the vehicle used in these paints being alkali proof and therefore requiring no treatment of the surface before the paint is applied. Paints of this nature are being used extensively on cement and concrete construction with the very best of results, and can be obtained at a very reasonable price.

Water Color Paints

"Water color paints" should not be used for exterior cement coating, as they do not form a waterproof coating (one of the most important requirements of a cement paint) and offer no protection from deteriorating influences.

For interior cement surfaces no better material can be employed in the way of paint than an approved flat wall paint. Most of the leading brands of flat wall paint being of an alkali proof nature, and where a gloss finish is desired any ordinary gloss paint or enamel may be applied over one or two coats of the flat paint.

All new laid cement surfaces, either exterior or interior, should be allowed to become thoroughly dried out and hard before painting, and the best results have been obtained where the work has stood not less than a month before paint was applied. If the surface is dry and the paint right, it will penetrate freely on the first coat, filling the pores and rendering the pealing impossible, but this would not be the case if applied over a damp surface.

Exterior cement paints should dry to a flat or semi-flat finish in order to carry out the stone or cement effect. Nothing looks more out of place than a full gloss paint applied to exterior cement surfaces.

Cement construction, especially of a lighter type as applied to residence work, is subject to very rapid deterioration unless protected and made waterproof by the application of a suitable paint, and while in the early history of cement construction little attention was paid to the matter, owing probably to the fact that cement work at that period was confined to rough, heavy construction, such as factories, warehouses, etc., at the present time all architects and builders recognize the fact that, aside from the embellishment and decorative feature whereby the cold, unfinished appearance of cement construction is made attractive and pleasing to the eye, the protective and waterproof feature is of great importance. It is being plainly demonstrated in many cases where cement-made houses have remained long unpainted, that exposed parts become watersoaked by afterwards freezing, and burst the bond, causing cracking and crumbling of the construction and, therefore, with the increasing use of cement construction, we may expect a greatly increased demand for the painting of these surfaces.

Painting of Cement Floors

The painting of cement floors, especially in factories, warehouses, stores and public buildings, is a necessity in order to prevent the constant powdering of the surfaces from the wear, with consequent damage and annoyance from contact with this lime dust. For cement floors, the same as for other cement surfaces, the paint must be of an alkali proof nature, but quick drying with a good gloss, and must produce a tough, elastic waterproof surface.

Many of the ready prepared cement floor paints, the quick drying vehicle of which is largely China wood oil, have been found to give excellent results, and I would recommend their use by the master painter, until such time as a more complete knowledge of the requirements in mixing of this material can be obtained. There is no doubt that, for some time to come, the master painter will be feeling his way, step by step, in his new realm of modern surface painting which cement construction has forced upon him. It will tax the brain of the paint chemist to formulate the vehicle with which to absolutely destroy the alkaline base which cement surfaces are loaded with, and it will be necessarily slow in reaching us, for time and elements are the only factors which will buy time exposure, and to show whether they have arrived at the point of absolute elimination or of perfect assimilation of the vehicle with the cement surfaces that is coated, therefore, will require patient effort. We are all aware that the goal has not been reached by any means, but constant scientific research will land us in the promised land of perfection, as it is doing in every other line of industrial development.

Relative Values in Sanitation*

By Geo. C. Whipple†

SANITARY measures are not always directed to a common end. Some are chiefly and avowedly for the protection of the people against disease, as for example, vaccination, disinfection processes, and the sterilization by the use of chemicals of public water supplies. Some measures are to protect people against accident. On the other hand, many of our most conspicuous and expensive sanitary operations, such as refuse disposal, street cleaning, ventilation of buildings and cars, promote comfort and convenience more than health. Again we have the element of decency which, though intangible, is nevertheless an important factor in the situation, as it merges interceptibly into morals. The proper disposal of the excretions of the human body is influenced by this motive. Between health, comfort and decency we often find it hard to discriminate and in attempting to evaluate them we encounter at the outset a great variety of philosophical conceptions.

Where no common denominator exists it is hard to make comparisons. As a matter of fact life, health, comfort and decency are prime factors and we cannot reduce them to lower terms. And so in deciding between measures which perform one or the other service we can do no more than exercise our best judgment, taking into account the sum total of the advantages to be derived from the measures recommended and our ability to pay for them.

But in order to judge wisely in regard to these matters it is necessary to be correctly informed as to what can be accomplished by sanitation and what need not be expected. This demands a careful study of the facts by persons competent to draw conclusions from them.

Popular Misconceptions

The popularization of sanitary science has been both beneficial and harmful. So rapid have been the advances in certain directions, so marvelous, for example, have been the results of bacteriological discoveries, that a spirit of over-confidence in new ideas has been developed. A flabby gullibility is taking the place of robust criticism. This is due in great measure to the manner in which scientific studies are exploited or "featured" by the press. False and misleading headlines are read by the many, while the articles themselves, often of a very different tenor from the headlines, are read by but few; hence the quick reading public may get one opinion, while the more studious reader may get an entirely different opinion from the same page. When, as in one instance, public opinion is so influenced by diluted science as to cause the legislature of one of our states to propose a law requiring the sewage of all cities to be purified in a septic tank, the matter becomes more serious.

Hence one of the most important things to be done in considering relative values in sanitation is to educate the public as to what can be accomplished and what cannot be accomplished by the various sanitary measures that are continually being proposed.

A Few Comparisons

It may be interesting to run over some of the sanitary measures in common use with reference to the nature of their usefulness, bearing in mind that the statements made are very general in character and subject to modification under exceptional conditions.

The purification of public water supplies has a very important influence on public health. But apart from this influence clean water, as contrasted with water which is turbid, discolored, or ill smelling, has a value of its own.

Sewerage that is the removal of water closet wastes from human habitations, is an important health measure. Sewerage has also a value reckoned in terms of comfort and decency.

Sewage treatment, sometimes miscalled sewage purification, except in special cases, has but a small influence on the public health. Nevertheless it may be very important when judged by standards of comfort and decency.

Street cleaning has an influence on public health, but its value lies chiefly in comfort and convenience.

Refuse collection and disposal has but little direct influence on the public health. Its value lies chiefly in comfort and convenience.

The ventilation of buildings and other enclosed spaces is only to a slight extent a health measure. It relates chiefly to personal comfort.

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* Abstracted from a paper presented at the annual meeting of the Connecticut Society of Civil Engineers.

† Consulting Engineer, New York City, and Professor of Sanitary Engineering, Harvard University.

The congestion of population in the crowded districts of cities considered by itself and apart from the habits of the people, probably has less influence on the transmission of diseases than is commonly supposed, yet there is reason to believe that it has an important influence on what may be termed human vitality. Room congestion when associated with ignorance and poverty, is an important factor in public health.

The elaborate devices employed in house plumbing to prevent the entrance of sewer air and drain air into the rooms have but a slight influence on the public health. They do, however, promote comfort and may perhaps enhance human vitality.

The control of the mosquito by the elimination of bodies of standing water and the use of oil is in many places an important health measure. It is also an important measure considered from the standpoint of personal comfort.

The elimination of the fly by the control of its breeding place, chief of which is manure, is, in the absence of proper care of fecal matter and other body excretions, a measure which affects the public health. Likewise it is a matter of personal comfort.

It must not be understood that street cleaning, refuse disposal and sewage treatment, which are usually controlled by municipal authorities, have no influence on public health. Of course they do have an influence. But the minor cleansing operations performed by the people themselves in their homes and schools and places of business, the practice of personal habits as will prevent the transmission of living organisms from person to person through such agencies as the common use of papers, pencils, toys, drinking cups, and the like, have a greater influence. This results from the general principle that the most dangerous infection is recent infection and that in general the life of pathogenic bacteria outside of the human body is not long.

Municipal cleansing operations began before the world knew much about the transmission of disease by means of living organisms. The relation between filth and disease was suspected, however, and it is probably fair to say that most of the cleansing measures that have been in practice for many years were first undertaken chiefly from the motive of protecting the people against disease. While science has shown that their influence in this direction is less than was once thought, yet we may be justified in continuing them from the standpoint of comfort, convenience and decency. It is evident from the general tenor of current discussions and from municipal appropriations, that the general public still regards them as measures that relate primarily to health.

The safeguarding of food against infection and putrefaction is a health measure, but food sophistication is chiefly an economic question.

In general it may be said that mankind needs clean air, clean water, and clean food, and needs them, too, in sufficient amounts. The quantity of food as well as its quality is important, but this question runs away from sanitation into economics.

Cost of Sanitation and Health Conservation

In the recent special report of the United States Bureau of Census on the financial statistics of cities for 1912, figures are given which show the relative cost of those measures which tend to promote cleanliness, and which are classed under the general term sanitation, and other measures which more directly affect the health of the people. It is interesting to notice that more than four times as much money is usually spent for measures which affect the public health indirectly as for those which are directly influential in controlling disease. If we consider all of the cities of the country which have populations higher than 30,000, we find that the cost of sanitation amounts on an average to $1.42 per capita per year, while the expenses for health conservation amount to only $0.35 per capita per year. The figures in Table 1 show that the per capita expenses of both sanitation and health conservation increase considerably as cities become larger, but that the percentages which these expenses are of the total municipal expenses remain practically constant fo all cities whatever their size, averaging 8 per cent. for sanitation and 2 per cent. for health conservation.

If the saving of lives is to be placed above comfort and decency it would seem logical for many cities to increase the appropriation for the work of their health departments.

Very often the cleansing operations are considered as a part of the health expenditures. In the light of modern bacteriology this is unwarranted.

The Dollar for Dollar Standard

Let us now consider some of the standards that may be applied to the various sanitary measures. First we have what may be called the Dollar for Dollar Standard. If we in America are to be true to our caricatures we should put this at the head. We should do the things that bring dividends and keep clean and well because it pays in dollars and cents, and because it costs money to be sick and to die and to be buried. Although this argument has moral shortcomings it is sometimes used, and it must be admitted that the dollar, as a commensurable unit, has advantages.

The money standard may be applied in two ways, first as a unit measure of cost and, second, as a unit of value applied to the product. To the first use one can hardly take exception; the second is less exact, but even so it may be usefully applied. We say that pure water saves lives; that lives have a value; and that this value is subject to calculation. In this way we compute the effect of a water filtration plant in dollars and cents and compare this value with its cost to determine whether the filter is paying a dividend on the investment. Figured in this way we usually find that the filtration of a polluted water does pay a very good profit. For example, the filter in Albany, N.Y., which was installed in 1899 reduced the typhoid fever death-rate in that city from 104 to 26 per 100,000, and also decreased the death rate from other diarrheal diseases. Taking current assumptions for the value of the lives that would have been lost had the filter not been built, and assuming a daily water consumption of 100 gals. per capita, we arrive at the result that the value of lives saved was about $76 for every 1,000,000 gals. of water that was supplied and inasmuch as the cost of the process did not much exceed $10 per 1,000,000 gals., the filter may have been said to have yielded in its early days a sevenfold profit.

In the same way we may study the various sanitary and hygienic measures that relate to the saving of lives of young children, such as motherhood training by district nurses, the pasteurization of milk and the like, and here also we find that the value of the lives saved, estimated in dollars, is larger than the cost of the protective work and we can compute the profit. And so we might go through the list and find whether the money spent in the eradication of smallpox is a paying proposition and that for the suppression of tuberculosis, and whether hospitals pay and Red Cross nurses and the lighthouse service of the United States Government.

In doing this we should come across some unexpected results. For example, does the treatment of sewage pay as a life-saving agency? Most people at first thought would say "Yes," but on study the proof of this fails to materialize.

In considering sanitary expences on the dollar for dollar basis we find that money spent for some forms of sanitation reduces other costs. Cleansing of the atmosphere from smoke reduces the laundry bills, lessens the need of air washing, and furthers the growth of vegetation. Money spent for sewage treatment may mean that streams and harbors have added value as parks and playgrounds. Money spent for water softening means less money spent for soap and the care of boilers. In various ways one expense may be substituted for another with the enhancement of personal comfort as an additional item.

Value of Human Life.—In making these calculations we are in the habit of attributing a certain value to a human life. We say, perhaps, that a man of a certain age earns so much above his cost of support, that he has a certain expectation of life and therefore his prospective value to society is so much. Economically this is doubtless true. The man's dependents recognize it, but does society recognize it? Chapin asks this pertinent question. "When a man dies do the people who are left believe that their own wages would have been higher if the man had lived, by reason of his worth to society? If they think about it at all are they not more likely to argue to the contrary and say that, in accordance with the law of supply and demand, limitation of wage-earners tends to increase wages?"

Thus, however much we may compute and argue on economic grounds, the dollar for dollar standard does not appeal to the mass of people. Bond issues for sanitary reforms will not be voted in order to conserve human life reckoned as economic wealth. The saving of life for its own sake is a far more powerful argument for the establishing of life-saving agencies than any appeal to the pocketbook. Humanity, after all, is what counts.

Again we often hear this—I quote from a prominent sanitarian: "No expenditure can be too great if a single human life is saved. Life is priceless." From an individual standpoint this may be accepted, but the world knows that in the aggregate this is not true. If people actually believed that life was priceless wars would cease, and people would stop taking chances of accident in automobiles and aeroplanes. The theory of the priceless life carried to extremes would be ridiculous. What we call life-saving is in itself something of a misnomer. Actually it is only life lengthening. This is recognized in the new phrase that we are beginning to hear—"life extension."

The Life Standard

There is, however, a very proper and very useful way to employ the money standard in sanitation, and that is to find in what direction the expenditure of a given sum of money will save the largest number of lives. This is one of the greatest questions that a sanitarian can consider. It is today the most important of all hygienic problems because it comprehends all others.

We spend our money for life extension partly by the inertia of old habits and partly by the spur of each new discovery in science.

We take up the new ideas one by one and ofttimes push them to extremes, regardless of their relative worth. Their newness obscures their true value.

If the life-saving agencies are to yield their best results we must place them upon a quantitative basis. That is to be the keynote of the new era upon which we are entering. Some might call it "Efficiency in the conservation of life."

The Vitality Standard

Another standard which has never yet been put into actual use relates to the effect of municipal environment on the physique and vitality. Do cities yield as strong and healthy men as the country? Does good ventilation add to one's strength and stature? Does factory sanitation lessen the discomfort and the burden of toil as well as increase the efficiency of the laborers? As yet no means have been devised for applying this standard. Some weight should be given to it in comparing the relative value of sanitary measures. Health has its positive as well as its negative side. It would not be out of place to consider expenditures for parks, for fresh air excursions and for public baths as health measures.

The Standard of Comfort

Money and length of life are not the only things to be considered. It is what lies between one's birth and death that really counts. Of what avail to add a few years to the length of life if personal comfort and happiness are not also enhanced! What, after all, is the chief end of man, to live long upon the earth, or to obtain the best enjoyment from the best environment? Whatever may be our philosophy we must admit that our five senses deserve consideration. Judged from this standpoint, some of the sanitary arts which do not yield a dollar profit begin to loom large.

Clean streets, clean houses, clean cars, clean rivers and clean harbors have a value because they tend to make life more comfortable, more decent and more moral. Sewage treatment, while it does not pay large vital dividends, may yet yield a profit measured in terms of comfort and decency. To what extent can physical comfort and happiness be secured in a tenement house where people live crowded together 1,000 to the acre, 43 sq. ft. of land for each person, a square 7 ft. on a side, not much larger than a respectable lot in a cemetery? The greatest evil of congestion is that true home life is rendered impossible. The greatest evil of machine labor is that the laborer gets no mental pleasure from his work. The lack of home comforts and comfortable working conditions is bound to influence both vitality and health.

Sanitary Surveys

In applying these general ideas to any particular case it is necessary first of all to obtain a general view of all the local conditions. This demands a sanitary survey.

The sanitary survey is not a new idea. Such surveys were made in many cities of Europe and America 50 and even 100 years ago. The histories of the surveys made in Boston, New York and elsewhere are of great interest and deserve careful study by modern sanitarians. In our new surveys we find history repeating itself—but with one difference. We now have a knowledge of the germ theory of disease and this has resulted in a changed point of view.

The planning of a sanitary survey should be placed in the hands of some one sufficiently familiar with all phases of the problem to give each its true value. Usually it is preferable to have it conducted with the co-operation of the municipal authorities, for they alone have access to the most important statistical material. For example, the survey which is being conducted in Cambridge, Mass., is in charge of a commission composed of the city engineer, the superintendent of streets, the health officer and two university professors. The results of such surveys are likely to show unbalanced allotment of the funds devoted to sanitary work. A slight readjustment might result in the saving of many lives. When the practice of sanitary surveying has progressed somewhat further than it has, it may be desirable to standardize the methods of expressing the results. Possibly a system of grading the sanitary conditions of cities may be devised, similar to the scoring system now applied to milk farms.

An important part of any sanitary survey is the study of the vital statistics of the community under investigation. This must not be confined to a mere study of crude death rates. It is necessary to take into account births as well as deaths and so consider the composition of the population as to age, sex, nationality and occupation, and social and economic conditions.

Perhaps no branch of science has had more misuse than that of vital statistics. In this respect we are behind, and not ahead, of the statisticians of former days. We are too much inclined to deal with crude death rates and general averages, quite forgetting that the individual observations are of much more importance than the average. We do not analyze our statistical material with that degree of care which is necessary to a full understanding of the facts. We are likewise inclined to make statistical comparisons of data between which there is no causal relation. During the last generation there has been a marked decrease in the crude death rate in cities the world over. We have been too quick to assume that this decrease has been due to improved sanitation and the rise of the science of bacteriology. To be sure this has been an important influence, but we forget that a large part of the decrease has been due to falling birth rates and immigration of people of middle age and that there are close relations between death rates, birth rates, marriage rates and economic conditions. We also see it stated that the sanitary condition of a city is measured by its infant mortality rate, a fact which does not appear to be borne out by statistical evidence. The death rate from children's diseases has been steadily decreasing for a generation and this may be fairly attributed to improved environmental conditions; but it is only within a comparatively short time that infant mortality rates have declined and this decline appears to be associated more closely with motherhood training than with sanitation.

Finally, what is most needed is a careful correlation between vital statistics and the sanitary conditions of our cities. This demands a minute analysis of the statistical material. At present our health department reports are utterly inadequate to enable the necessary correlations to be made. In order to determine relative values in sanitation it will therefore be necessary to develop anew the science of demography, a science destined to profoundly influence the health, lives and morals of the race.

The Decorative Value of Concrete

IN a recent issue of the American Architect the possibilities of concrete for artistic construction are discussed in a leading article, the following extracts from which will probably interest many of our readers. Our contemporary points out that many of the economic conditions existing to-day parallel those of the Roman Empire which two thousand years ago led to the extensive use of concrete, though in less variety of purpose than it is now employed. Brick and building stone are not always locally available along the lines of railroads, and are always expensive to transport. Further, their use requires the services of workmen who, in many instances, must be brought from a distance, maintained, and paid a rate of wages based on supposed, but not always realized, efficiency.

The materials for concrete, however, are easily and cheaply available in almost any locality. Aggregate suitable for most kinds of concrete, if not taken from the actual excavation, may almost always be found near it, and as cement is manufactured in many centres and its weight comprises but a small fraction of the total, the cost of transportation is comparatively small. The mixing and putting in place of the concrete is efficiently, quickly and easily accomplished by the joint efforts of machinery and a ready supply of cheap labour, under skilled superintendence.

Economic and other advantages having directed attention to concrete, its use was for a long time devoted almost exclusively to the more massive forms of construction, such as foundations, piers and heavy retaining walls. But as economic conditions in certain circumstances become more insistent and some of the inherent virtues of the material become more obvious, the attention of a few architects was perhaps unwillingly drawn to the architectural treatment of a material which clients importuned them to use.

Naturally, the first tendency to make the surface of concrete simulate that of building stone, was too strong to resist even by those who most loudly preached the policy so that its face shall have even the mechanical form of stone ashlar, or to simulate joints on the surface of a monolithic wall for the same purpose, is an obvious attempt at deception. Such treatment not only asserts a quality which is lacking in concrete, but denies the user the advantages of its unique qualities. There are its plasticity, permitting it to be cast or moulded in forms of any size and almost any shape, and its composition of cement and aggregate making possible a great variety in surface treatment.

Perhaps the greatest opportunities for the architectural treatment of concrete are in the broad wall surfaces of monolithic construction. For precedents we have been referred to the stuccoed walls of the California missions with their unaffected simplicity and agreeable proportion and spacing of openings. We cannot afford to neglect any suggestions based on tradition when wrestling with a new problem, but the pioneers who have been most successful are those who have studied the problem and have worked it out on its own merits.

Concrete can no longer be regarded as a gross material suited only for heavy, massive construction; it is a plastic material and comprises an aggregate which, when properly selected, makes possible an infinite variety of effects in an infinite number of forms. There has been recently a considerable appreciation of its possibilities, but the future architect will undoubtedly develop these even more broadly.

Montreal Builders' Exchange

As the result of a further meeting of the Montreal Builders' Exchange to consider the situation created by the war, it was decided to appoint committees to approach the Bankers' Association or the Minister of Finance with a view of securing more money for building purposes; to interview the Government and the wholesale people in Montreal on the subject of the price of foodstuffs; and to consider the question of a wages scale for all classes affected by the contracting business. The chief topic of discussion was on the latter question, and there was considerable difference of opinion as to the wisdom of attempting to cut wages with the object of inducing capitalists to restart building operations. It was pointed out that many contractors have agreements with the Unions, and the former ought to stand by these agreements. On the other hand, it was said that it is certain people with money will not build unless some inducement in the way of lower costs is held out, and that it is better for workmen to accept say 30 cents an hour than to practically starve. It was made clear that the Builders' Exchange has no desire to reduce the scale of wages, and that the suggestion of a lower scale is with a view of keeping the trade from utter stagnation.

The question of the cost of builders' supplies was also raised, and it was said that the prices of materials are excessive. Other speakers made strong complaints of the action of banks in restricting loans to firms, thus preventing work being carried out.

Mainly Constructional

East and West—From Coast to Coast

EASTERN CANADA

Toronto's share of the cost of the Toronto-Hamilton road will probably be $150,000. A grant to this amount is favored by Council.

The annual convention of the Royal Architectural Institute of Canada, which was to have been held at Quebec this week, has been postponed indefinitely.

At Toronto, the International Petroleum Company, Limited, has been incorporated with a capital of $20,000,000, to carry on a general oil and refinery business.

Excavation has started on the new Registry Office which is being built at Toronto at a cost of $400,000. The architect for the building is Mr. C. S. Cobb, of Toronto.

It is of interest to note the incorporation at Montreal of the St. Denis Theatre Company, capitalized at $750,000. No announcement as to building plans has yet been made.

Plans have been prepared for the one-million-dollar factory to be erected at Hamilton, Ont., by Messrs. Proctor & Gamble, of Cincinnati, Ohio. No contracts have yet been awarded.

Announcement is now made that operations will be commenced shortly on the Toronto-Hamilton highway, under the direction of the provincial government. The estimated expenditure is $600,000.

The Hamilton, Ont., Board of Control have recommended a grant of $20,000 towards the construction of the Hamilton-Toronto road, and an additional $10,000 to pay Hamilton men engaged on the work.

Work on the completion of the National Transcontinental Railway is being rushed forward. Eleven thousand men are now engaged. The expectation is that the whole line will be ready for operation by October.

The City of Hamilton is about to call for tenders upon material for building a mile of concrete sewers, estimated to cost $110,000. The work is to be done by day labor. Mr. A. F. MacCallum is the City Engineer.

At Collingwood, Ont., operations are proceeding on the post office building, which the Dominion Government is erecting at a cost of $108,000. The general contractors are Messrs. Healy, Herrington & Bryan, Collingwood.

The Ottawa City Council have approved the plans of Messrs. Hazen & Whipple for the Ottawa River water supply and have instructed the Board of Control to expedite construction in order to provide employment this winter.

At Quebec, arrangements are already being made for extensive municipal improvements next spring. The expenditure on sewers, watermains and roads mapped out so far runs into two million dollars. Mr. W. D. Baillarge is the City Engineer of Quebec.

At Windsor, Ont., the Canadian Bank of Commerce will erect a new bank at a cost of $150,000. The building will be four-storeys high and of fireproof and brick construction. Excavating has commenced. The architect is Mr. D. G. Horsburgh, Toronto.

Plans are being prepared for the new central station which it is proposed to erect at Quebec at a cost of $1,000,000. The building will be the joint project of the Canadian Pacific and Transcontinental railroads. The architects are Messrs. Palmer, Hornbostel & Jones.

Tenders are about to be called for the erection of the new office building which the Ontario Hydro-Electric Commission proposes to erect on University Avenue, Toronto, at a cost of $300,000. The contractor for the excavating is Mr. W. H. Thomson, who has started work.

The Toronto City Council has adopted the report of the Board of Control recommending the installation of a garbage disposal plant at $480,000 and tenders will be called as soon as the plans are complete. As announced previously in these columns, the scheme embraces the erection of four separate plants. The Toronto Street Commissioner is Mr. G. B. Wilson.

For the first time, the Association of American Portland Cement Manufacturers have held their annual convention in Canada. The convention was held on September 14-17 at the Windsor Hotel, Montreal. There were about 150 delegates. Committees presented reports on "Technical Research," "Uniform Cost Sheets," "Conservation" and "Accident Prevention." These and other subjects, including concrete roads, were discussed. The delegates visited the No. 1 plant of the Canada Cement Company at Pointe aux Trembles, the harbour, and the new grain elevator, and also went down the Lachine Rapids.

WESTERN CANADA

Saskatchewan has set an excellent example in providing work on road construction for 150 crews of men. The expenditure to be made under the Provincial Highways Commission is not less than $500,000.

The progress of road construction in Saskatchewan is highly satisfactory and the work of the Provincial Road Commission has come in for considerable commendation. More than 1,500 men and 1,000 teams are now at work.

One day of the International Irrigation Congress, which is to be held in Calgary, October 5 to 9, this year, is to be devoted to a trip covering a 160-mile journey through the irrigation block lying to the east of Calgary, and a visit of inspection to the Horseshoe Bend dam near Bassano, which stores water for the largest individual project on this continent.

The City Council of Vancouver are inviting competitive designs for the development of the proposed civic centre. Premiums amounting to $500 and $250 will be given to the first and second designs respectively. The closing date for entrance is November 30.

The McLeod Block, Edmonton, which is involving an expenditure of $450,000, is nearing completion. The building is a ten-storey structure, faced with terra cotta and brick. The architect is Mr. J. K. Dow, of Edmonton, and the general contractors are Messrs. Olson & Johnson, of Edmonton.

From Regina comes the cheering information that municipal work estimated to cost $380,000 is to be put in hand immediately. The City Council has drawn up a programme which means employment for a large number of men this winter. One of the items is a five-million-gallon reservoir.

Messrs. Sutherland Construction Company are the general contractors for a warehouse which is to be erected at Ross and Ellen streets, Winnipeg, at a cost of $125,000, by the Midland Railway Company of Manitoba. The building will be two storeys high, 400 ft. by 70 ft. in dimensions, of pressed brick construction.

Foundation work has been completed for the proposed armoury at Prince Albert, Sask., which is to cost $250,000. The architect is O. Albrechtsen, of Prince Albert, and the general contractors are Messrs. Piggott & Healy, of North Battleford. The Manitoba Bridge & Iron Works, Winnipeg, have the contract for the steel.

An additional $40,000 is to be expended on the new drill hall now in course of construction at Victoria, B.C. This will bring the outlay to nearly $300,000. Work is being started by the contractors, Messrs. Parfit Brothers, and it is hoped to have the building ready early next year. The architect is Mr. Ridgway Wilson.

At Winnipeg, constructional operations are proceeding on the new warehouse for the Midland Railway Company of Manitoba. The building, which is estimated to cost $125,000, will be two storeys high, 70 ft. by 400 ft. in dimensions, of pressed brick construction. The general contractors are the Sutherland Construction Company, Winnipeg.

Operations are progressing on the store and office building which John Kelly is erecting at Edmonton at a cost of $125,000. The construction is reinforced concrete and brick and the building will be five-storeys high. The architects are Messrs. Van Siclen & Macombe, and the general contractors are the Zenith Construction Company, both Edmonton firms.

An important Order-in-Council of vital interest has been passed covering the contract for a subsidy with the Amalgamated Engineering Works, Limited, of British Columbia for the construction of a modern drydock at Vancouver, to cost $6,500,000. It is understood that the financing was completed in London before the war broke out. The proposed drydock will be 1,150 feet long and 100 feet wide, and capable of being divided into two sections, one 650 feet long and the other 500 feet. It will be one of the largest drydocks in the world. The subsidy will cover $5,500,000. This scheme has no connection with the plant now being erected for the Dominion Drydock & Shipbuilding Company, whose site is located near this project.

Good progress is being made with the construction of the big Grand Trunk Pacific drydock at Prince Rupert. This dock, costing $3,000,000, will have in all twelve pontoons. The first of these was launched last week. It is 130 feet long and, exclusive of other fittings, has 300,000 feet of timber in its construction. A second pontoon is to be launched on the 22nd inst., and six pontoons will be completed by January 1st. The capacity displacement of the series will be 20,000 tons, and each pontoon will be fitted with two powerful centrifugal pumps, so that when the ship is in place the water can be pumped out rapidly and repair work begun. The dock is so arranged that it can be used in three separate units, or in any combination that is desired. A large number of men are employed on the construction work. The dock is only one of many large projects Prince Rupert has on hand at present.

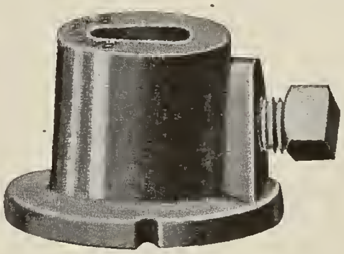
Industrial Notes

The Toronto Plate Glass Importing Company, Limited, have opened an office at 1010 New Birks Building in charge of Mr. A. P. Major.

Witting Bros., Limited, glass and metal importers, with head office in London, Eng., have removed from 46 Notre Dame Street West to larger offices at 403 McGill Building, Montreal.

The Universal Form Clamp

The Universal Form Clamp, an illustration of which appears herewith, is finding much favor among concrete contractors. The device has been used on many of the large buildings under construction this season, and over two thousand clamps are at present in use on the erection of the new Canadian Kodak Building. It is claimed to be a positive locking device when used upon a rod, and its action is the same as a bolt or nut with this distinction, however, that the tie is secured in fifty per cent. less time. The Railway-Contractors Supply Company, Toronto, are agents for Ontario and Eastern Canada. They have appointed Messrs. Ramsay & Kelly, 511 Quebec Bank Building, Montreal, their representatives in that territory.



The Canadian Dolarway Paving Company, Limited, have just completed the repairing and resurfacing of Wyandotte Street, Windsor, with Dolarway Bitumen. When this contract was awarded, a by-law had been passed, providing for the construction of the work with asphalt blocks, at an estimated cost of $63,000. The Dolarway construction, which is guaranteed for three years, has effected considerable economy.

We have become accustomed to using electrical goods which are "made in Germany" for such a long time that we are apt to wonder how we are to get along now that we are cut off from that country. In this connection it is refreshing to note that Pulsynetic Impulse Clocks are a "home-made" production, being manufactured at the works of Gent & Company, Limited, of Leicester, Eng. It may be mentioned also that "Invariable" of non-expanding nickel steel for pendulums was almost exclusively a German production until Gent & Company, Limited, some years ago introduced British-made "Sinevar" non-expanding nickel steel. "Sinevar" steel has a co-efficient of expansion of only .0000010 per degree centigrade and all Pulsynetic Time Transmitters are fitted with pendulums of this extremely useful alloy, which accounts largely for the remarkable time-keeping which can be obtained from these instruments.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Edmonton, Alta.
City Council is to carry out construction of two miles of paving on Stoney Plain Road, 18 ft. wide. National Paving Company, First St., is general contractor.

Fort Erie, Ont.
Tenders are invited by J. H. Jackson, Engineer, Ellis street, Niagara Falls, for construction of Concrete Roadway for Town Council and Victoria Park Commission, at estimated cost of $30,000. Plans and specification with engineer.

Galt, Ont.
Town Council is constructing concrete wall on west side of river.

A by-law is to be voted on for construction of 4 ft. cement sidewalk on east side of Lowell St. Jas. McCartney is the clerk.

Hamilton, Ont.
Tenders will be called shortly for material in connection with construction of one mile concrete sewers in East End, at estimated cost of $110,000. City will do work by day labor. A. F. Macallum is engineer.

Medicine Hat, Alta.
Mayor Brown has recommended expenditure this year of $50,000 on cement walks. Herbert Baker is clerk, and A. K. Grimmer engineer.

Montcalmville, Que.
Work is to start next spring on construction of sewers, water main, sidewalks, etc., at estimated cost of $2,000,000, for City Council. W. D. Baillarge, 50 St. Louis St., is Engineer.

Ottawa, Ont.
The construction of asphalt pavement on Primrose Avenue is contemplated by the City Council.

City Council is contemplating construction of Asphalt Pavement on Gloucester St. F. C. Askwith is Engineer.

City Council has instructed Board of Control to commence work on Ottawa River Water Works Supply system, estimated to cost $2,000,000. Consulting engineers, Geo. W. Fuller Company, New York City. City engineer, Arch. Currie, City Hall.

Owen Sound, Ont.
Town Council has authorized construction of concrete roadway on 10th Street, at estimated outlay of $500,000. Work will commenec shortly. Union Cement Company is supplying cement at $1.40 per barrel.

Regina, Sask.
City Council having raised necessary amount for completion of 5,000,000-gallon steel and concrete reservoir, work is to commence. J. M. McKay is the engineer.

City Council has authorized construction of sewers on 15 streets and watermains on 12 streets. Estimated cost $50,000.

Revised estimates place contemplated extension of Sewage Disposal Works, including construction of additional filter beds, at $50,000. F. McArthur, engineer, is in charge of the work.

Saanich, B.C.
The Municipality is voting on by-law to raise $375,000 for water system and construction of water mains.

The Municipality has decided to expend $450,000 on Street Paving and Grading. Hector S. Cowper is the clerk.
The cost of grading and paving road scheduled for in paving plans and as set forth in by-laws soon to be voted on are as follows: Quadra Street, $10,000 and $46,000; Saanich, $33,500 and $174,000; Burnside Road, $37,500 and $42,000; Gorge Road, $5,250 and $31,000; Douglas Street, $2,850 and $25,000; Shelburne Street, $18,000 and $52,200.

St. Catharines, Ont.
Work is to start at once on construction of asphalt concrete pavements on six streets, approximately 25,000 square yards. Estimated cost $50,000. Foley & Gleeson, Central Chmbrs., Ottawa, General Contractors. W. D. Near is Engineer.

Toronto, Ont.
Tenders close September 29 with Board of Control, for construction of Asphalt Pavements on ten streets, Bitulithic on two streets, Brick Block on two, Concrete on four; also Curbings and Walks.

Provincial Highway Commision is to proceed shortly with work on Concrete Roadway, for 33 miles between Toronto and Hamilton, under direction of Special Commission to be appointed by Provincial Government. Roadway will cost $600,000. Mr. W. A. McLean, Provincial Parliament Bldgs., is the Engineer.

Vancouver, B.C.
The engineering staff of Vancouver and District Joint Sewerage and Drainage Board has completed plans and estimates for proposed Sewer on Balaclava Street. Work will be done by day labor and construction will probably be started at once.

Victoria, B.C.
City Council has approved of a paving programme for Duchess St. Wellington J. Dowler is the clerk.

Winnipeg, Man.
Estimates are prepared by W. P. Brereton, engineer, for construction of plank sidewalks on city streets.

CONTRACTS AWARDED

Galt, Ont.
Town Council has awarded general contract for construction of bitulithic pavement on Ainslie St. N., to Warren Paving Company of Ontario, at $1.55 per square yard.

Kingston, Ont.
City Council has awarded general contract for paving of Princess St., to Kingston Construction Company.

New Westminster, B.C.
City Council has awarded general contract for construction of Sapperton sewer outfall on Columbia Street, to R. W. MacLean, Pacific Bldg., Vancouver. Estimated cost, $76,313.

Niagara Falls, Ont.
The contract for 1,700 square yards of concrete sidewalks has been awarded to Ferris & Manley.

St. John, N.B.
The following contracts have been awarded by City Council: Concrete Base and Sidewalk on Queen Sq., Moses, French & Simes, 29 Brunswick St., $2,517.32; Concrete Retaining Wall and Sidewalk on Tower St. W., $687, Peter Ferris, 24 Brunswick St., General Contractor, and F. L. Potts, Commissioner of Works.

Toronto, Ont.
The following contracts for sewer construction have been awarded by Board of Control; Danforth Avenue, National Contracting Company, $1,698; West Toronto Sewer System, division No. 2 outlet, W. E. Taylor, 138 Clinton Street, $4,895; Armadale, $2,169, Glendonwynne, $2,360, Windermere, $5,365, Connolly Agnew Company, 606 Avenue Road.

Board of Control has awarded the following contracts for asphalt pavements: Coxwell Ave., $15,947; Leslie St., $11,590 to Constructing and Paving Company, Confed. Life Bldg.; St. Clair, $16,266; Langford, $11,827; Earle, $2,577; Gothic, $9,946; Coxwell Ave., $8,535, to Commr. of Works.

The following contracts for construction of bitulithic pavements, etc., have been awarded by Board of Control:—Commr. of Works, Alexandra Boulevard, $7,475; Hillcrest Drive, $8,380; Lytton Boulevard, $8,510; Bathgate, $11,787; Turner Road, $5,416; Ashdale, $11,062; Bracondale Hill Road, $2,038. Contract for curbings on Humberside has been let to W. E. Ransom, Dineen Bldg., and sidewalks on Beech Avenue, to Riverdale Concrete Paving Company.

Railroads, Bridges and Wharves

Edmonton, Alta.
Surveys are being made by C. F. Law, Athabasca Landing, preparatory to construction of railroad in North Alberta

and Peace River district, connecting with steamship line on Mackenzie River. Owner is D. S. Thompson, Cardiff, Wales.

Medicine Hat, Alta.
Work will commence this fall on construction of Railway Line by Canadian Northern Railway from Medicine Hat to a point 25 miles north, provided Dominion Government advances money to finance the undertaking. H. F. Forest, Winnipeg, is District Engineer.

North Vancouver, B.C.
The Dominion Government is reported to have granted a subsidy to Amalgamated Engineering Company, Limited, for construction of $6,500,000 dry dock and wharves here; drydock will be 1,150 ft. long and 100 ft. wide, divided into two sections.

Quebec, P.Q.
The Canadian Pacific Railway and Commrs. of Transcontinental Railway, Ottawa, have plans in progress for construction of Central Station on St. Paul Street, at estimated cost of $1,000,000. Palmer, Hornbostel & Jones, New Birks Bldg., Montreal, Architects. R. C. Ryan is the Secretary.

Stratford, Ont.
The City Council has in contemplation the laying of approximately 1¾ miles of street track, on concrete base, on Arthur, Brock, Nelson, Alfred and St. Paul Ave., estimated cost $35,000. Also the purchase of six cars estimated to cost $30,000. T. H. Jones is Consulting Engineer, and C. H. Hartman, Chairman of Railway Commission.

Toronto, Ont.
Tenders are wanted for construction of Concrete Bridge, estimated to cost $1,250,000. Full information from James, Louden & Hertzberg, Engineers, 79 Adelaide street east.

The Board of Control has reported funds for construction of subway on Innis Avenue, estimated to cost $7,170. Work, which will be of concrete construction, will probably be done by day labor.

Vancouver, B.C.
Plans have already been filed and McNeil, Welch and Wilson, Limited, 80 Pender Street E., propose constructing a Wharf on False Creek.

Victoria, B.C.
Pacific Great Eastern Railway has filed plans for Extension of Railway Line along Shore of Anderson Lake, also line on Shore of Seaton Lake.

Winnipeg, Man.
Work is to start at once on construction of Spur Line by Midland Railway Company of Manitoba, into premises of Ross & Isabel, on Ross and Ellen Streets.

Business Buildings and Industrial Plants

Brampton, Ont.
Tenders are now being received by Audrey Butler, Architect, 104 Main Street, Niagara Falls, in connection with construction of Jam Factory for Lindners, Limited, 340 Dufferin Street, Toronto. Sub-tenders wanted by Sutherland Construction Company, Ryrie Building, Toronto. Building will be one and three storeys, and basement, 100 ft. by 150 ft., mill and hollow tile construction.

Cochrane, Ont.
The Town Council has received plans for construction of Jail Building, one-storey, with provision for second-storey. Cost not to exceed $3,700. Harry Brown is the Clerk.

Guelph, Ont.
Architect W. A. Mahoney, Telephone Building, is receiving tenders for construction of two-storey brick Skating and Curling Rink on Baker Street, at approximate cost of $12,000, for Victoria Skating Rink.

Hamilton, Ont.
Work is to start very soon upon the construction of a $35,000 hospital kitchen on Barton East, for Hospital Board. Work on main addition may be recommenced at an early date. Stewart E. Whitton, Hamilton Provincial Loan Bldg., is the Architect. All tenders in, but contract not yet awarded.

Plans have been drawn by owner and architects, Proctor & Gamble, Cincinnati, Ohio, for Factory in East End, estimated cost $1,000,000. Excavation to start in about a month. No contracts yet awarded.

London, Ont.
Plans are drawn for Store Front on 432 Richmond Street, for C. P. Heal, 184 Central Avenue, at estimated cost of $8,000. The contractors are: carpentry and steel, Tambling & Jones; masonry, Evans Bros.; metal front, Kawneer Company, Toronto. Structure will be three storeys, brick piers, steel beam overhead, plate glass, metal sash.

Montreal, Que.
Plans are in progress and tenders will be received by P. A. Westover, Architect, Keith Theatre Building, Philadelphia, Pa., in a few days, for general contract to construct $300,000 theatre on St. Denis, near St. Catherine, for Imperial Theatre Company, Bleury St. Barott, Blackader & Webster, New Birks Building, are Assoc. Architects.

The general contractors, Raymond Construction Company, 46 St. Alexander Street, are taking prices on plumbing, heating, plastering and painting in connection with alterations to stores and residences on Beaver Hall Hill. Estimated cost $3,000. E. Payette, 103 St. Francois Xavier Street, is the architect.

In connection with construction of Store Fronts for Berlin Gramophone Company, Limited, 415 St. Catherine Street, West, the general contractors; Laird Paton & Son, Limited, 485 St. James Street, are taking prices on tiling.

A permit has been obtained by A. Amgot, 340 City Hall Avenue, for erection of one-storey addition to restaurant. Estimated outlay, $1,300.

New Westminster, B.C.
The plans of Mr. Turnbull, Building Inspector, have been approved and City Council will proceed at once with erection of Storehouse and Stables on Eighth Avenue and Eighth Street.

Napanee, Ont.
In connection with $45,000 Drill Hall being constructed for Dominion Government Department, Public Works, Haggorty & Company, Brockville, masonry contractors, will require cement, crushed stone, sand, gravel, building stone, common and faced brick, anchor bolts, reinforced steel and waterproofing.

Ojibwa, Ont.
Preliminary work is to be started on erection of $20,000,000 Steel Manufacturing plant near Windsor, for United States Steel Corporation, New York City. Branch of Essex Terminal Railway (approximately one mile) is also to be built to site.

Ottawa, Ont.
Central Canada Exhibition Association, Sparks Street, are contemplating erection of Brick Stables, Sheds, etc., on Exhibition grounds. Edward McMahon, Sparks Street, is the Secretary.

E. Renaud, 325 Clarence Street, is contemplating construction of iron-clad and solid brick Stables and Sheds on Murray Street, at estimated outlay of $4,000.

M. Mahoney, Butler House, contemplates erection of stables, etc., on Hurdman Road, at estimated outlay of $3,000, to be frame construction, concrete foundation.

Regina, Sask.
W. Seller, 1711 Victoria Avenue, has obtained permit to erect $3,500 store on Albert Street. General Contractor, J. G. Traub, 2105 Rae Street.

St. Jerome, Que.
Architects Benoit & Girard, Southam Building, Montreal, have received tenders for general contract in connection with construction of two factories, one storey each, 50 ft. by 100 ft., brick construction.

Simcoe, Ont.
The Town Council is to proceed with construction of Hydro Plant, including sub-station, also construction and installation of eight miles of lines. Estimated outlay, $40,000. W. C. McCall is the Clerk.

Toronto, Ont.
A permit has been issued to H. G. Marshall, 507 Davenport Road, to construct 2-storey addition to mill at Madison and Davenport, estimated cost $1,000. Work not yet started.

Tenders are being received by H. Simpson, Architect, 13 Wellington St. West, in connection with construction of three Stores and Apartments, three storeys, brick construction, on Queen Street.

A. J. Rattray, Architect, Stair Bldg., is receiving bids for $8,000 addition to Bakery on 462 Eastern Avenue, for L. Brown. Addition will be two storeys, brick construction.

A permit has been issued to Toronto Hydro-Electric Company, for construction of storehouse on Ruskia and Edwin streets, at estimated cost of $2,400.

A permit has been issued to T. W. Mathews, 665 Spadina Avenue, to erect a $1,500 garage.

Plans are drawn and work will start at once on construction of stores and residences on Bloor Street West, to cost $11,000. Owner and general contractor, J. W. Devitt, 92 Albany Avenue. Masonry and Carpentry, day labor. Tenders wanted on roofing, plastering, heating, plumbing and electric work. Building will be three storeys, brick construction.

Plans are drawn but work has not yet commenced on four attached Stores and Residences on Gerrard St., estimated cost $16,000, for W. H. Shell, 2191 Gerrard St. Buildings will be three-storeys, brick construction. Darling and Pearson, Leader Lane, are the Architects.

Vancouver, B.C.
General Contractor J. T. Frantz Construction Company, Arts and Crafts Building, is receiving tenders for plastering and laying 100,000 bricks, in $6,000 store for Mr. Robt. Alexander, 1640 Larch Street.

A party of Boston capitalists are reported to be in communication with the City Industrial Commissioner on the question of securing a suitable site for contemplated Box Factory on Fraser River. It is said that construction work will commence next spring. Factory will be large and will employ about two thousand hands.

Welland, Ont.
Machinery is now being installed in $30,000 brick and structural steel building for Electric Steel and Metal Company. Work on other three buildings, which will be complete plant for treatment of steel and iron ore by electric process, will be started next spring. The Standard Steel Construction Company are general contractors. David Carnegie, 335 Carter House Square, London, Eng., is the architect.

Windsor, Ont.
Plans are in progress in connection with construction of $2,000 garage on Victoria Avenue for Dr. J. S. Labelle. Atcheson & Adams, Labelle Building, are the architects.

CONTRACTS AWARDED

Maisonneuve, Que.
The contract has been awarded to Anglins, Limited, 65 Victoria Street, for construction of four-storey brick warehouse, at a cost of $70,000, for St. Lawrence Sugar Refineries, Limited, 145 St. James Street. J. J. York, 730 Notre Dame Street, is the architect.

Montreal, Que.
The general contract for $75,000 five-storey addition to laundry, 425 Richmond Street, for Toilet Laundry Company, Limited, has been awarded to A. F. Byers & Company, 340 University Street. Hutchison, Wood & Miller, Royal Insurance Building, are the architects.

Winnipeg, Man.
The contract for constructing Engine House at Point du Bois, estimated cost $2,200, for City of Winnipeg, has been awarded to Ernest Hill, 156 Garry St. J. G. Glassco, 54 King St., Winnipeg, is Engineer.

Public Buildings, Churches and Schools

Bemner, Alta.
North Clover Bar School District has been authorized to borrow $1,200 for erection of School and equipment. J. T. Trueman, Bremner, is Sec.-Teas.

Maisonneuve, Que.
The contract for building Church for Maisonneuve Methodist Congregation has been awarded to Anglins, Ltd., 65 Victoria St. Peden & McLaren 20 Alexis Street, are the Architects.

Nanaimo, B.C.
The Library Committee has submitted a report regarding a $50,000 Carnegie grant for Public Library. City Council will be requested to submit by-law to ratepayers for erection of Library.

Navan, Ont.
Tenders will be received by Jas. Cotton, Navan P.O., until noon, September 24, for supply of materials and erection of four-roomed school for Cumberland School Board. Plans and specifications at office of Architects, Richards & Abra, Booch Building, Ottawa, and at Post Office, Navan.

Ottawa, Ont.
Work is to start immediately on construction of $30,000 Club House for Ottawa Canoe Club, Rockcliffe. Piling will be done during the winter. C. P. Meredith is the Architect.

Perth, N.B.
Tenders for School building will be received by Secretary, R. B. Ritchie, School District, No. 14, until September 25. Plans and specifications at Dionne Hotel.

Simcoe, Ont.
Town Council contemplates erecting a $10,000 addition to town hall on Peel Street, same design as present building, two-storeys, cut frill stone and white brick construction. W. C. McCall is the Clerk.

Toronto, Ont.
Tenders close with Sec.-Treas., W. C. Wilkinson, Board of Education, September 25, for all trades in connection with addition to Huron Street School.

In connection with addition to Essex Street School, tenders for all trades close September 25, at 4 p.m. Tenders also received for plumbing, drainage, electrical and cabinet work on various schools. W. C. Wilkinson is Sec.-Treas.

Victoria, B.C.
Work is expected to be completed about May 15th, 1915, on the $125,000 Church in course of construction at Quadra Fisguard, for trustees of First Presbyterian Church. H. C. M. Keith, 416 Sayward Building, is the Architect, and Stevens Brothers, General Contractors.

Westmount, Que. (Montreal)
Plans are in progress and work is proceeding this fall on construction of City Hall on Sherbrooke Street, for City Council. A. F. Bell is Sec.-Treas., and Kenneth G. Rea, Guarantee Building, Montreal, Architect.

CONTRACTS AWARDED

Toronto, Ont.
The following contracts have been awarded for Marguerетta Street School building by the Board of Education:—Masonry, G. T. Gayton, 56 Lyall Ave., $23,943; carpentry, Crocker & Ledrew, 185 Ossington Ave., $9,560; plastering, Haddock & Son, 792 Crawford street, $1,898; painting, R. G. Johnston, 17 Galley Ave., $1,400; roofing, J. T. Flowers, 200 Markham street, $339; iron stairs, Canadian Ornamental Iron Co., 88 River street, $2,840; concrete work, Ramsay Contracting Co., 39 Indian Road Cres., $1,309. Building will be 9 rooms, brick construction.

In connection with Euclid Ave. School building the following contracts are awarded:—Masonry, Teagle & Son, 55 Boswell Ave., $26,980; carpentry, F. Armstrong, 89 Oak street, $10,189; plastering, Haddock & Son, 792 Crawford street, $2,489; painting, Taylor & Company, 48 Borden street, $1,411.

The following additional contracts have been awarded for work on Guest Avenue Presbyterian church, Mount Dennis: wiring, Frame Bros.; painting, C. W. Landon; plastering, T. F. Chamberlain.

Additional contracts for Marguerетta Street School are as follows: heating and ventilating, J. R. Seager, $4,280; plumbing, J. R. Seager, $4,290; wiring, Bennett & Wright, $250; masonry contract is transferred from G. T. Gayton to Teagle & Son ($26,000).

The general contract for work in connection with Malvern High School has been awarded by Board of Education to Dersemoth Contracting Company, 79 Adelaide East.

Additional contracts awarded by Board of Education for work on Euclid Avenue School include the following: Purdy Mansell Limited, heating, plumbing and ventilating, $9,599; J. T. Flowers, roofing, $439; A. J. Penberthy, concrete floors, $875; Canadian Ornamental Iron Company, iron stairs, $2,800; A. R. Rice Company, wiring, $277.

The Board of Education has awarded the following contracts in connection with addition to John Fisher School: Masonry, Palmer Bldg. & Contracting Co., McKinnon Bldg., $6,279; carpentry, Croker & Ledrew, 185 Ossington Ave., $6,230; plastering, Haddock & Son, 792 Crawford St., $1,000; painting, Robert Morse, 186 Avenue Rd., $530; roofing, A. Matthews, Ltd., 256 Adelaide W., $322; heating and ventilating, F. Armstrong Co., Queen W., $4,152; plumbing, J. R. Seager, 799 College St., $1,740; concrete, A. J. Penberthy, 292 Booth Ave., $400; iron stairs, Can. Orn. Iron Co., 88 River, $966; wiring, Bennett & Wright, Queen E., $218.

The following are the contractors and prices for Carlaw Avenue School building: mason, J. H. Champion, 716 Logan Ave., $25,180; carpentry, Wm. Williamson, 137 Woodbine Ave., $11,775; painting, James Phinnemore, 445 Yonge St., $1,275; heating and ventilating, Keiths, Ltd., Campbell Ave., $5,179; concrete, A. J. Penberthy, 292 Booth Ave., $936; plastering, Haddock & Son, 792 Crawford St., $2,450; roofing, J. T. Flowers, 200 Markham St., $286; iron stairs, Can. Orn. Iron Co., 88 River, $2,737; plumbing, F. Armstrong Co., Queen W., $4,268; wiring, Bennett & Wright, Queen E., $247.

Residences

Barrie, Ont.
Plans are drawn for $3,000 residence on Bradford Street, for Wm. A. Simmons. General Contractor, carpentry, roofing and interior fittings is Mr. Catlin, Allandale, Ont.

Dundas, Ont.
Plans are drawn for $4,000 residence

at Dundas for F. A. Nelson, King St., Hamilton. Jas. Watson is the architect.

Maisonneuve, Que.
Tenders are open and separate bids will be received by architects Hutchison, Wood & Miller, Royal Insurance Bldg., Montreal, for all trades in connection with $15,000 residence on Jean D'Arc and St. Catherines Streets, for St. Lawrence Sugar Refineries, Limited.

Montreal, Que.
A permit has been issued to E. Masse, 137 Cherrier Street, to carry out alterations to flat.

Jos. Fairion, 529 Nicolet Street, has obtained a permit for alterations to two flats.

Ottawa, Ont.
D. Cuthbertson, 710 Echo Drive, is contemplating erection of residences on Broadway.

New tenders will be called and work started in the near future on construction of $9,000 residence on Daly Avenue, for Chas. A. McColl, 445 Wilbrod Street. W. E. Noffke, Central Chmbrs., is the architect.

Port Haney, B.C.
The contract will be awarded shortly for a $2,000 residence for Thos. Patterson.

Quebec, Que.
In connection with $6,000 residence on Lockwell Street, P. Jobin & Frere, 286 St. Oliver Street, are receiving tenders for masonry, roofing, plastering, painting, heating and plumbing. Building will be three storeys, brick construction.

Tenders for painting are invited by Dme. Vve. Beaule, 320 Arago Street, on a three-storey, $7,000 residence.

Material for painting $5,000 residence on Bougainville Ave., is being purchased by L. A. Tremblay, 312 Richardson St., owner and general contractor.

E. C. Brochu, 166 Lockwell St., is buying material for plastering $10,000 residence on Cyrille St., of which he is owner and general contractor.

Material for painting, plumbing and electrical supplies is being purchased by A. Conor, 141 Richardson St., in connection with $10,000 residence on Fourth Street.

Toronto, Ont.
In connection with $8,000 Detached Residence on High Park Blvd. for C. W. Carter, General Contractor J. L. Hill, 18 Wheeler Avenue, is receiving tenders for slate roofing. Residence is 2½-storeys, brick construction.

Tenders for all trades except masonry and carpentry are invited by J. S. Hill, 154 Wheeler Ave., in connection with construction of Detached Residence near St. Clair Avenue, for B. F. Carter. Residence will be 2½-storeys, stone and brick construction, slate roofing, and is estimated to cost $6,000.

A permit has been issued to E. G. McBride, 199 Willow Avenue, to erect a $2,500 Detached Residence on Scarboro Road.

International Capitalists, Limited, 93 Queen E., have obtained permit to erect Detached Residence on Silverthorn Avenue, estimated to cost $1,600.

Tenders wanted at once by general contractor, J. Calow, 105 Wychwood Avenue, for heating, plumbing, and electrical work on Detached Residence, 156 Wychwood Avenue.

A building permit has been obtained by W. Tattle, 27 St. John's Road, for addition to residence on 62 Vernon Ave.

Plans are drawn for one pair $4,000 residences on Mackay Avenue, for W. J. Turner, 99 Mackay Avenue. Work not yet started.

W. Reid, 21 Cambridge Avenue, has had plans prepared for construction of one pair $3,500 residences, two-storeys, brick construction. Work not yet started.

Plans are drawn and work will start at once on detached residence on 46 Duggan Avenue, for T. Thompson, 204 Major Street.

W. Rutledge, 242 Clinton Street, has otained a permit to build $3,000 residence, two-storeys, brick construction, on 92 Indian Road.

Winnipeg, Man.
Halgrimson & Company, Grain Exchange Building, intend building apartment block this year, provided necessary finances can be arranged.

CONTRACTS AWARDED

London, Ont.
Contracts for construction of 2½-storey solid brick Parsonage for Dundas Central Methodist Church, at estimated cost of $7,500, have been awarded as follows: masonry and stone, Wm. Nutkins & Sons; carpentry, J. H. Wallace; roofing, M. Whittaker; plastering, Scott & Son, painting, Howe & Son, heating and plumbing, Eggett & Co.; electrical work, Electrical Contracting Company, Dundas.

Ottawa, Ont.
Jas. H. Greer, 116 Fourth Avenue, has obtained general contract for alterations to interior of Thos. H. Dunn's residence, Elgin Street.

The contract for erection of Sun Room on Metcalfe Street, estimated cost $2,500, for Thos. Birkett, Metcalfe Street, has been awarded to Taylor & Lackey, 23 First Avenue.

Power Plants, Electricity and Telephones

Edmonton, Alta.
Messrs. Sanderson & Porter, of New York, financiers and builders of hydro-electric plants, have proposed to furnish the City with electric power. Proposed plant, with minimum capacity of 300,000,000 kw.h. transmitted by cable to Edmonton, would be erected at Moose River and Yellowstone Pass of Rockies. Estimated cost of project, $3,500,000.

Kingston, Ont.
Civic Utilities Commission is considering offer from F. M. Campbell to supply 500 h.p., generated at Kingston Mills.

Merrickville, Ont.
The ratepayers have passed a by-law authorizing the loan of $30,000 to Merrickville Electric Light & Power Company for construction of electric power plant. D. J. Hall is Clerk.

Montreal, Que.
Department of Public Works, Ottawa, (Sec. R. C. Desrochers, Ottawa), will receive tenders until 4 p.m., Oct. 7, for installation of two Electric Passenger and six Freight Elevators in Examining Warehouse, Montreal. Plans and specifications at office of Mr. R. L. Desrochers, Supt. Dominion Buildings, Montreal, and at Department, Ottawa. Specifications at office of MacLean Daily Reports, Limited, 220 King Street West, Toronto.

Peterborough, Ont.
The Hydro-Electric Commission plans to improve and extend the hydro-electric system at a cost of about $100,000. Work will soon be begun.

Quebec, Que.
Tenders for electrical supplies for $14,000 Residence in course of erection will be received by L. A. Desrochers, 151 St. Oliver Street.

City Council is contemplating construction of Boiler Room on Beauport Road, at estimated cost of $150,000. Building is to be steel and red brick construction. J. L. Pinsonnault, City Hall, is the Architect.

St. John, N.B.
Dominion Government Department of Public Works (R. C. Desrochers, Ottawa, Sec.), invites tenders until 4 p.m., October 7, for installing one Passenger and one Freight Elevator, also Electric Ash Hoist, in new Post Office. Plans and specifications at office of Mr. D. H. Waterbury, Supt. Dominion Buildings, St. John, N.B., and at Department, Ottawa. Specifications at office of MacLean Daily Reports, Limited, 220 King Street West, Toronto.

Transcona, Man.
Bids desired until Sept. 26 by City Secretary-Treasurer for furnishing and installing pumping machinery, including electrical equipment. W. M. Scott, Engineer, Sterling Bank Bldg., Winnipeg.

CONTRACTS AWARDED

Transcona, Man.
The contract for erection of garbage and refuse incinerator has been awarded to Ideal Incinerator Company, Toronto.

Miscellaneous

Bracebridge, Ont.
Tenders will be received by R. C. Desrochers, Sec. Department Public Works, Ottawa, until 4 p.m., Sept. 30, for interior fittings including screen, wickets, desks, cupboards, drawers, etc., for post office. Plans and specifications at office of Mr. John Jermyer, Clerk of Works, Bracebridge; T. A. Hastings, Clerk of Works, Postal Station "F." Toronto, and at Department, Ottawa. Specification at office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Lindsay, Ont.
W. G. Blair & Sons, Kent Street, will require Interior Fittings including counters, shelves, show cases and lights.

Fittings including desks, counters,

wickets, racks, etc., are required in connection with Post Office on Kent Street, for Dominion Government Department, Public Works. Jas. Bogue, Lindsay, is General Contractor.

Markdale, Ont.
Tenders will be received until October 1st, for Low-Pressure Steam Heating Plant for Revere House. Plans at hotel or office of Architects, Forester & Clarke, Owen Sound.

Ottawa, Ont.
Engineer F. C. Askwith has been asked to report on proposed Lavatories and Comfort Station. Architect will be chosen later.

Saskatoon, Sask.
Tenders are invited for supply of complete Well Drilling Outfit for F. Sheppard, 212 Twentieth Street.

Toronto ,Ont.
Tenders will be received until October 13th, for Fire Alarm Boxes, Hocker sets, copper wire, circuit wheels, etc., for fire alarm telegraph. Specifications, etc., at Fire Department, Adelaide Street W.

Welland, Ont.
R. C. Desrochers, Secretary Department of Public Works, Ottawa, will receive tenders until 4 p.m., September 30, for alterations and additions to Interior Fittings of Post Office. Plans and specifications with T. A. Hastings, Clerk of Works, Postal Station F., Toronto; T. McIlvride, caretaker, Post Office, Welland, and at Department, Ottawa.

Business Notes

Athens, Ont.
Residence and barn belonging to Stephen King has been destroyed by fire. Loss partly covered by insurance.

Midale, Sask.
A loss of over $47,000 was sustained by various occupants in the destruction by fire of large warehouse, etc. Loss partly covered by insurance. Principal losers, Midale Hardware Company.

Moncton, N.B.
Car barn belonging to Moncton Tramways, Electricity & Gas Company were burnt down recently. Loss of $5,000 is covered by insurance.

Montreal, Que.
Messrs. R. H. Buchanan & Company have been awarded the contract for two vertical turbine centrifugal pumps and electric motors. The pumps will be used for fire service, Canadian Vickers' new shipbuilding plant, Maisonneuve, Que. Each will have a capacity of 1,500 gallons per minute against a head of 372 feet, and are Pulsometer Engineering Company manufacture. The electric motors are vertical type and along with control gear will be manufactured by Messrs. Vickers, Ltd., Sheffield, each being 250 h.p., 2,200 volts, 1,160 r.p.m.

Simcoe, Ont.
The cement warehouse owned by Wm. Sutton & Company, has been destroyed by fire. Loss $6,000, insurance $3,000.

The destruction by fire of Storehouse owned by Wm. Sutton involved a $6,000 loss. Insurance $3,000.

Sarnia, Ont.
Report published September 14th re lumber fire at Sarnia Sawmill Company's plant was in error. Quantity of lumber destroyed now stated to total in value $60,000.

Sussex, N.B.
Stores on Broad street, owned by Geo. W. Fowler, Court street, have been burned down. Loss $15,000, partly covered by insurance.

Toronto, Ont.
Coal sheds on Cherry Street, the property of Standard Fuel Company, 58 King Street, were burned down recently. The loss, $3,000, is covered by insurance.

Vancouver, B.C.
Macdonald Marpole Company, Agents for The Canada Wire & Cable Company, have received an order for a large quantity of two-pair twisted wire for the City of Revelstoke, B.C.

Woodstock, Ont.
An Ice House on Main Street, owned by Macdonald Estate, has been destroyed by fire. Loss $3,000.

New Companies

St. Denis Theatre Company, Montreal, P.Q., has been incorporated with a capital of $750,000.

St. Lawrence Canning Company, Montreal, with capital $50,000, has incorporated.

Colonial Brewing Company, Limited, Vancouver, B.C., has been incorporated with a capital of $400,000.

W. H. Taylor, Limited, have incorporated as Mechanical and Electrical Engineers and Machinery Manufacturers, etc., with head office at Montreal, and a capital stock of $50,000.

Campanello Steamships, Limited, have incorporated as Builders and Manufacturers of building machinery, etc. The capital stock of the company is $100,000, and the head office is in Toronto.

Turner & Gates have incorporated with a capital of $100,000 and head office at Toronto, to carry on the joint business of a Loan and Building company. The provisional directors are Fred W. Turner, Fred W. Gates and Jas. E. Day.

The following British Columbia companies have been incorporated:—Middle West Petroleum Company, Limited, $1,000,000. Pacific Standard Oil Company, Limited, $100,000. Lynn Valley Copper Company, Limited, $250,000. A. B. Cushing Lumber Company (Vancouver) Limited, $20,000. Auto Mud Track Co., Limited, $10,000.

International Petroleum Company, Limited, is incorporated with head office at Toronto. Its operations are to include the manufacture of mining machinery and building construction. Capital $20,000,000.

Metal Products, Limited, has increased its capital from $25,000 to $100,000.

W. H. Taylor, Limited, has incorporated as Mechanical and Electrical Engineers, manufacturers of lumber, rick, terra cotta, etc., with capital stock of $50,000. Head office will be at Montreal.

International Petroleum Company, Limited, has incorporated with capital stock of $20,000,000. The company's headquarters will be Toronto.

North American Improvement Company, Limited, has incorporated as general contractors, engineers, etc., with a capital of $200,000 and head office at Toronto.

Canadian Shipbuilding and Dry Dock Company, Limited, has been incorporated with $2,000,000. Company has power to construct wharves, docks, etc.

Late News Items

Brampton, Ont.
The contract for laying of sidewalks on various streets at Streetsville, Ont., has been awarded to William Rowe, contractor, Brampton, at 14½ cents per square foot.

Dresden, Ont.
Town Council has awarded the contract for granolithic sidewalks to Geo. E. Clarke, Dresden.

Hamilton, Ont.
Board of Control and Local Hydro Board have decided to get estimates on new Reservoir for Mountain Top.

Howard, Ont.
Tenders will be received until September 26 by Geo. McDonald, Clerk, for a number of drains and concrete culverts in Howard Township.

Niagara Falls, Ont.
Wm. Duncan, Morrison Street, contemplates making concrete blocks and will require Concrete Mixer and Block machinery.

Quebec, Que.
In connection with $8,000 residence on Fourth Street, Limoilon for F. D. Pare, 197 Third Ave., owner is now receiving tenders for electric supplies.

Saskatoon, Sask.
The Burnett Hardware store on west side of city has been burned down and $2,000 loss sustained. Mr. Burnett announces that store will be rebuilt as soon as insurance is adjusted.

Sydney, N.S.
The construction of $22,000 Business Block on Water Front is contemplated by A. M. Crofton, 291 Charlotte Street. Site purchased.

Thorold, Ont.
Town Council has instructed the Clerk to advertise for tenders for construction of sewers on several streets.

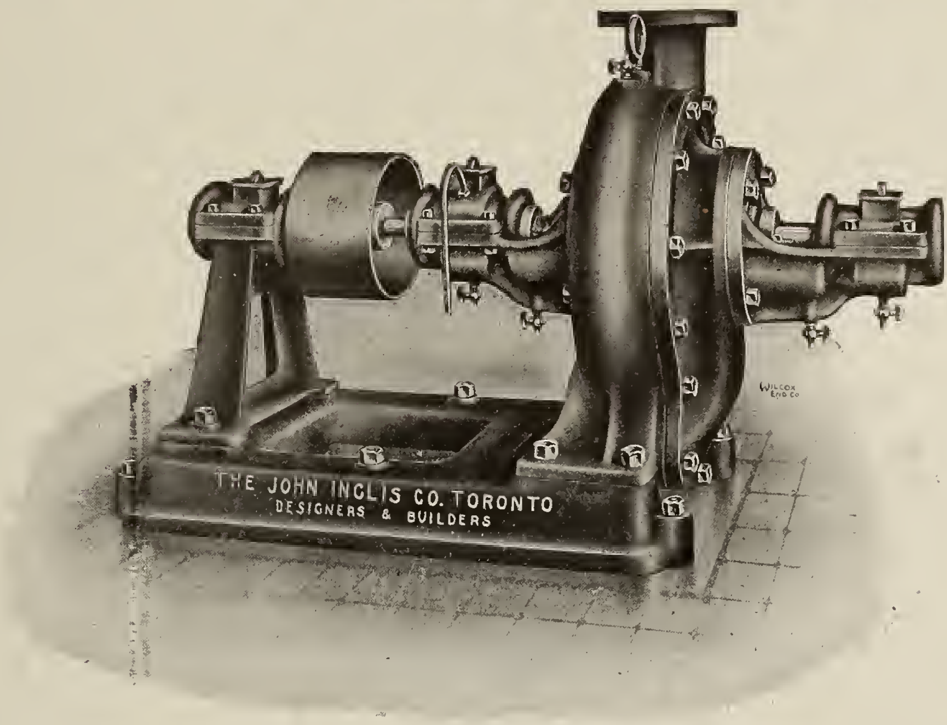
Toronto, Ont.
York Township Council has granted permission to N. MacEachern, to construct sewer, 300 ft. long, on Pape Ave. from city limits to Randolph Street at own expense, Council to repay cost as soon as debentures are sold.

The contract for constructing Sewer on Appleton Avenue has been awarded to the Grant Contracting Company, at $900.

All negotiations for purchase of Toronto Street Railway and Toronto Elec-

(Continued on page 66)

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Tenders and For Sale Department

Parkdale Canoe Club
Partial Completion

Tenders on above will be received till **Friday, October 2nd.**

Plans and specifications can be seen at the office of the undersigned.

GEO. N. MOLESWORTH, Architect,
38 2 College Street, Toronto.

Queen Victoria Niagara Falls Park

Road Construction

Sealed tenders addressed to the Queen Victoria Niagara Falls Park Commissioners and marked "Tenders for Road Construction, Section No. 5," will be received until **Monday, October 5th**, at noon, for the construction of a concrete roadway, with the necessary drainage through the Villages of Bridgeburg and Fort Erie, a total length of 8,500 feet.

Plans and specifications are on file at the Administration Building, Queen Victoria Park, Niagara Falls, Ontario.

JOHN H. JACKSON,
Superintendent.
Niagara Falls, Ontario.
September 19th, 1914. 38

Sealed tenders addressed to the undersigned, and endorsed "Tender for Electric Passenger and Freight Elevators, Examining Warehouse, Montreal, Que.," will be received at this office until 4 p.m. on **Wednesday, October 7, 1914**, for the installation of Two (2) standard passenger and Six (6) standard freight elevators, in the Examining Warehouse, Montreal, Que.

Plans, specification and form of contract can be seen and forms of tender obtained on application to this Department and at the office of Mr. R. L. Deschamps, Supt. Public Buildings, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, September 16, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—67153. 38-39

TENDERS

Will be received up to **October 1, 1914**,, for Low Pressure Steam Heating of the Revere House, Markdale, Ont. Plans and specifications may be seen at the latter place or at the office of Forester & Clarke, Architects, Owen Sound. 38-39

Vancouver Civic Centre
1914

The Committee appointed by His Worship Mayor Baxter invite competitive designs for the development of the proposed Civic Centre. Premiums amounting to $500 and $250 will be awarded to the designs placed first and second respectively. The award will be made by independent experts whose decision shall be final. All designs must be delivered not later than November 30th, 1914. Programme of competition and plans may be obtained from the Secretary, Vancouver Civic Centre Committee, care Vancouver Board of Trade, 543 Hastings Street West, Vancouver, B.C. 36-39

Sealed tenders addressed to the undersigned, and endorsed "Tender for Electric Passenger and Freight Elevators, Langevin Block, Ottawa, Ont.," will be received at this office until 4 p.m. on **Friday, October 9, 1914**, for the installation of three (3) standard passenger and one (1) standard freight elevators, in the Langevin Block, Ottawa, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to this Department, at the offices of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and Mr. R. L. Deschamps, Superintendent of Public Buildings, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, September 21, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—67143. 38-39

Fire Department
Supplies—Fire Alarm Telegraph—Appliances

Tenders for Firemen's Helmets, Peak Caps, Winter Caps and Fire Alarm Boxes, Joker Sets, Copper-clad Wire, New Circuit Wheels for Fire Alarm Boxes.

Tenders, addressed to the undersigned, will be received by registered post only, up to noon on

Tuesday, October 13th, 1914

for the supplying of the above-named articles.

Specifications and forms of tender may be obtained upon application at the office of the Fire Department, Adelaide Street Fire Hall, Toronto. The usual conditions relative to tendering as prescribed by City By-law, must be strictly complied with, or the tender will not be entertained.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman Board of Control.
City Hall, Toronto, Sept. 14th, 1914. 38

Late News Items

(Continued from page 64)

tric Company have been dropped for the present.

City Council passed five debenture by-laws totalling $1,284,343 to cover cost of Cold Storage plant at municipal abattoirs, constructing new Registry Office, completing new Technical High School, building Danforth Avenue and Gerrard Street Car Barns and erection of Dormitory and Cell Building at Industrial Farm.

The Board of Control has approved of a scheme of the Toronto Housing Company for purchasing 30 acres north of Danforth Avenue at $100,000. On this land houses will be erected and leased to workingmen.

Vancouver, B.C.
The Dominion Government has granted a subsidy to Amalgamated Engineering Company in connection with projected Dry Dock and Ship-Building Plant to be erected on North Shore. Preliminary plans will proceed forthwith. Construction will not commence on a large scale for some time.

Windsor, Ont.
City Council has awarded the contract for resurfacing of Chatham Street, from Windsor Avenue to Carron Avenue, and Park Street from Windsor Avenue to Carron Avenue (approximately 20,000 sq. yds.) to the Canadian Dolorway Paving Company, Limited, Royal Bank Building, Windsor.

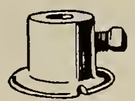


Fig. 1

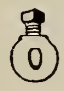


Fig. 2

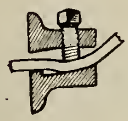


Fig. 3

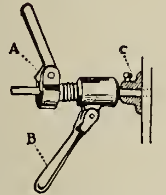


Fig. 4

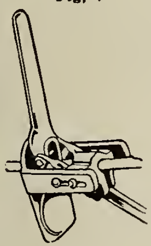
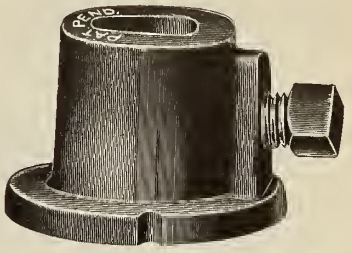


Fig. 5

Use UNIVERSAL CLAMPS

to convert any round rod into a bolt



Long bolts—removable bolts—bolts extending through timber and poured concrete—these are best for form work.

The Universal Form Clamp converts round rods of any size into threaded bolts with removable heads and adjustable nuts.

Fig. 1, in the column at the left, shows the clamp.

Fig. 2, shows the cross-section of the clamp, with the oval hole.

Fig. 3, is a longitudinal section. showing the clamp secured on the rod by the upset shoulder and the screw.

In operation, rods are passed through holes in forms. On one end of each rod a clamp is placed and screwed down.

Fig. 4, shows the tightening wrench which is slipped over the opposite end of the rod, after anothei clamp has been put in place. The wrench locks to the rod with the cam (A). Turning the handle (B) slides the loose clamp along the rod, against the form until the adjustment is exact. Then the clamp screw is tightened actually making a kink in the rod. When the wrench is removed, you have a long bolt securely holding forms together. The rod will break before the clamp will come off either end.

Fig. 5, shows the rod-puller used in withdrawing rods when forms are wrecked. The clamps are loosened and the rods are easily removed.

One Clamp for walls, columns and soffits This clamp is literally *universal* in application. With these low cost cast iron clamps and various lengths of steel rods, forms may be held rigidly in place during the entire process of building.

Write for circulars and prices. We'll send a sample clamp for 10c. to pay postage and packing.

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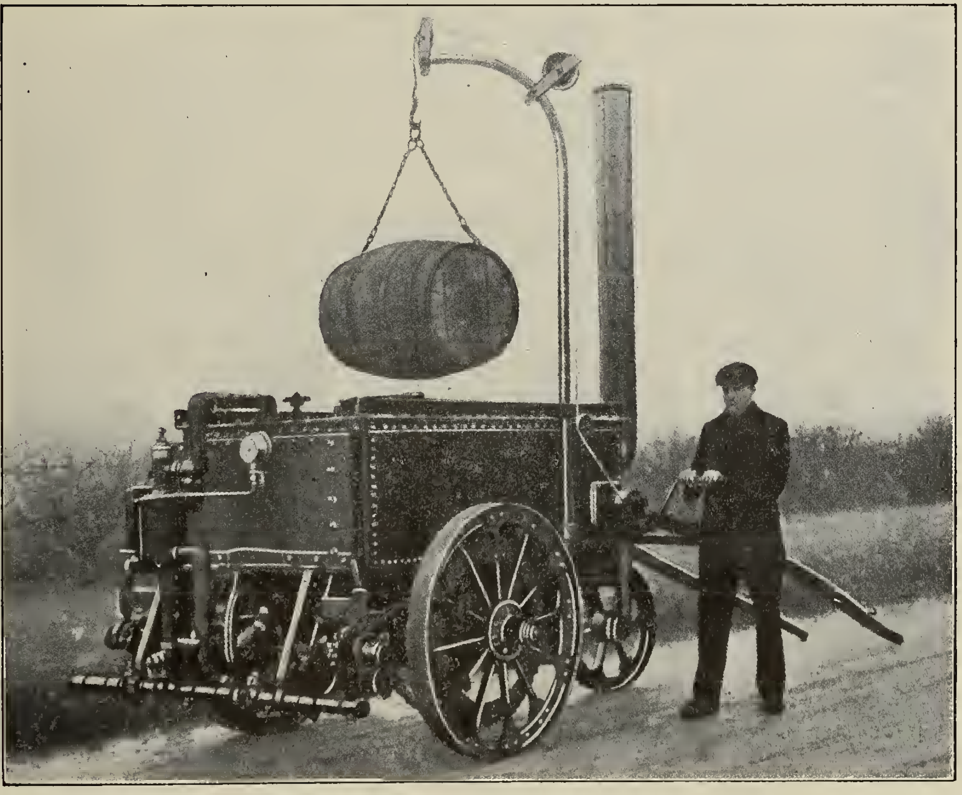

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Current Prices of Building and Engineering Materials

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $30; sand-lime brick, $8.10, King Edward Siding; $7 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.50; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.25; 1-in., $1.30; 3/8-in., $1.30; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in ditto $2; 8 in. pine base $2.75 to $3.25; 10 in pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22 $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Quotations withheld.

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto: 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge

Steel channels and beams, angles and plates—$4.

$2.50 to $3 per 100 pounds.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 15c basis, second grade 11c basis, sisal rope, 10½c basis.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 73c per gal. of 9 lbs.

Raw linseed oil—in bbls., 70c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 67c.

MONTREAL PRICES

CEMENT, LIME AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $9.25; C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal. Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in., 40c; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60 $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.). These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; British manilla, 13c basis; African hemp, 13c; sisal rope 10½c basis. Boiled linseed oil—in barrels, 60c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $110; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, delivered, $13 per cord.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16,

(Continued on page 9

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Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
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7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it.
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Samples, prices, analyses, etc., on request

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103-107 Board of Trade Building :: MONTREAL

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from p. .)

16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles.—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster.—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $8.85 per 100 lbs.; boiled linseed oil, in bbls., 71 cents per gal.; raw linseed oil, in bbls., 68 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B. C. fir)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse:

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.15 to $3.65.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square.

Steel channels and beams, angles and plates—$3.15 to $3.65 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c per ft.; 6-in., 40c. ft.; 9-in., 70c. ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.00 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$10.50 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 90c per gal. of 9 lbs.

Raw linseed oil—in bbls., 88c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c; turpentine in bbls., 95c.

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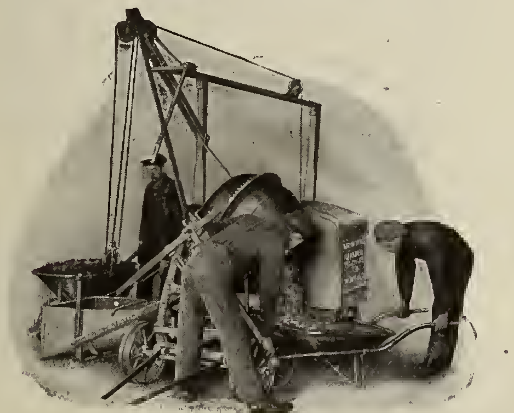

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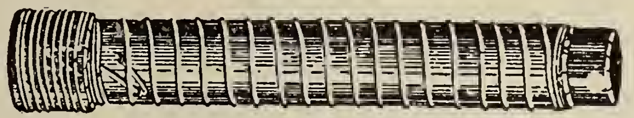

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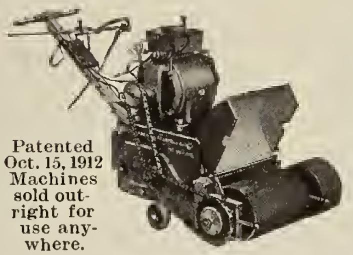

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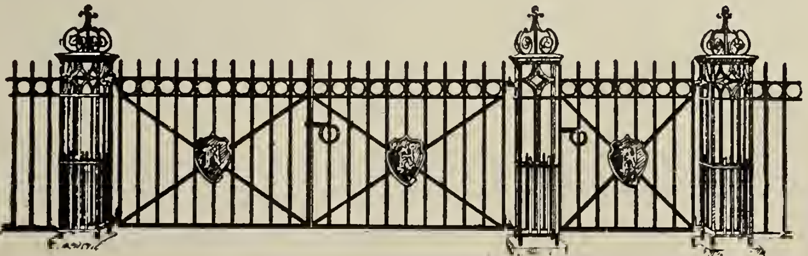

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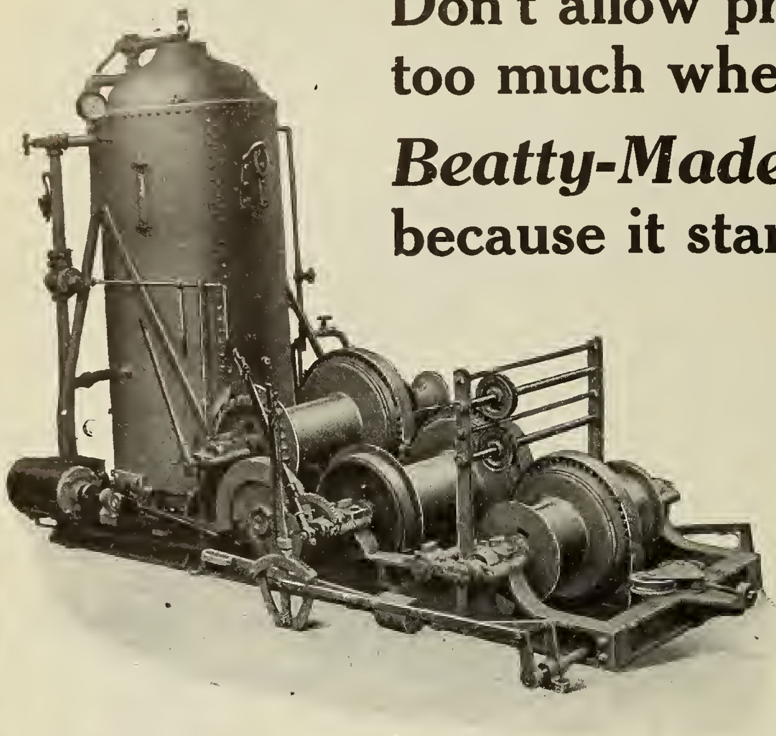

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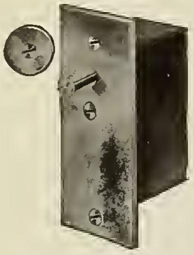

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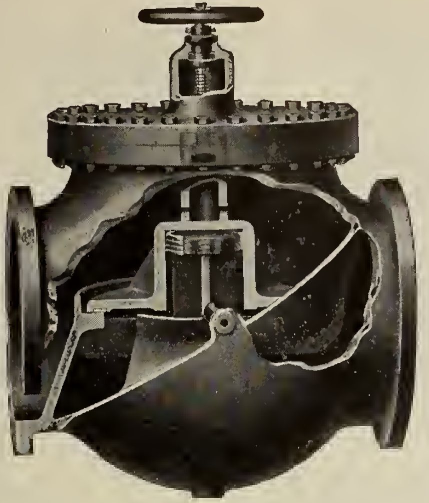

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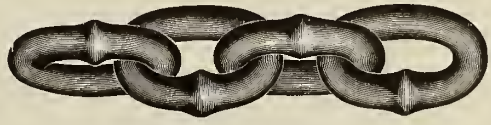

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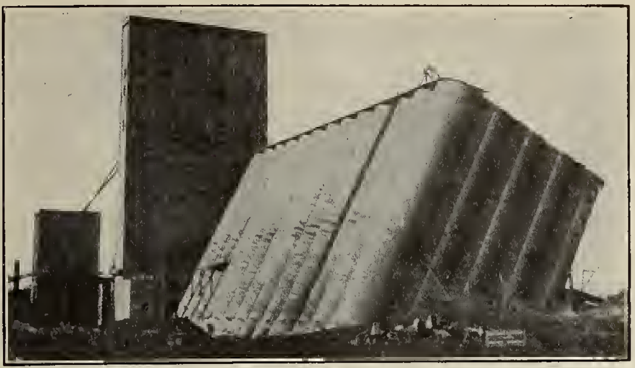

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The building in the illustration, built of concrete, was righted to its proper position without damage to structure.

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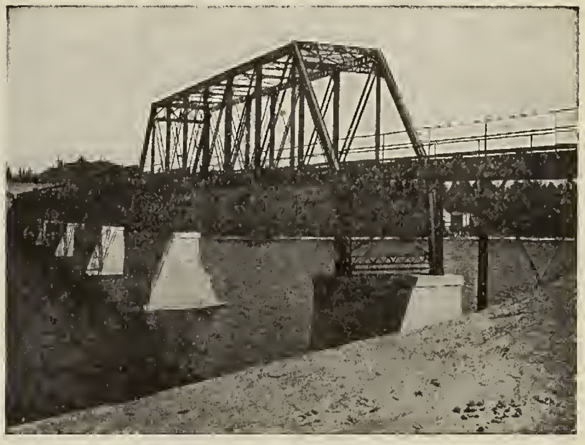

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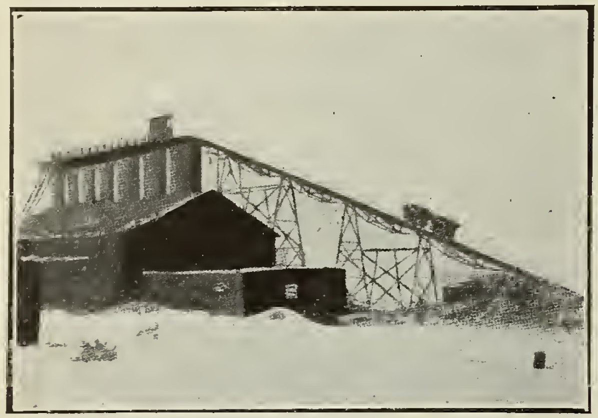

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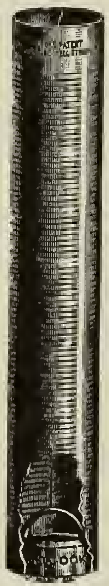

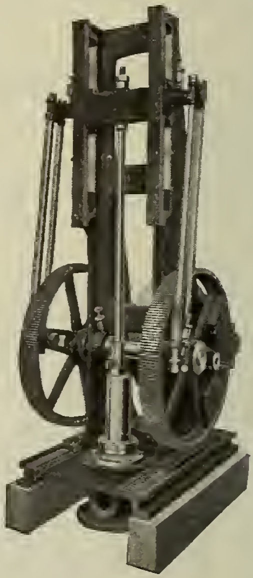

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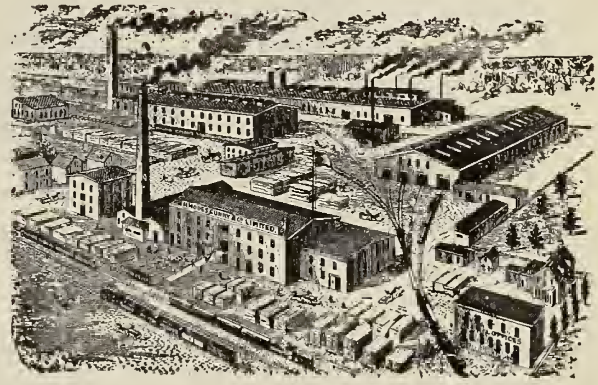

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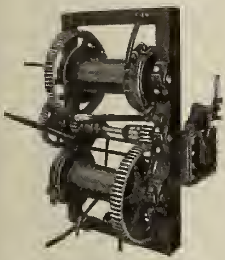

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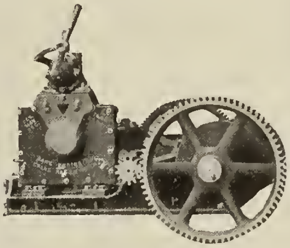

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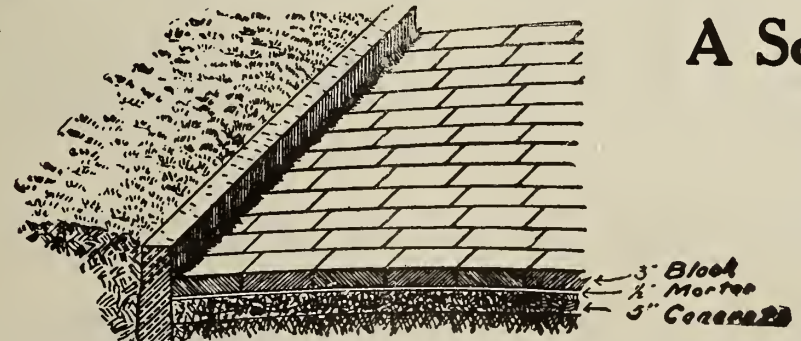

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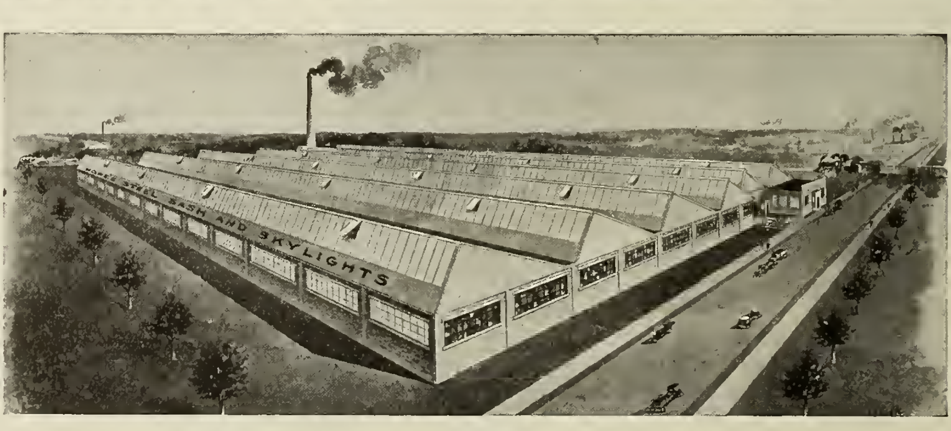

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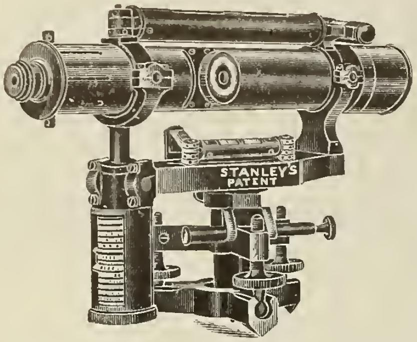

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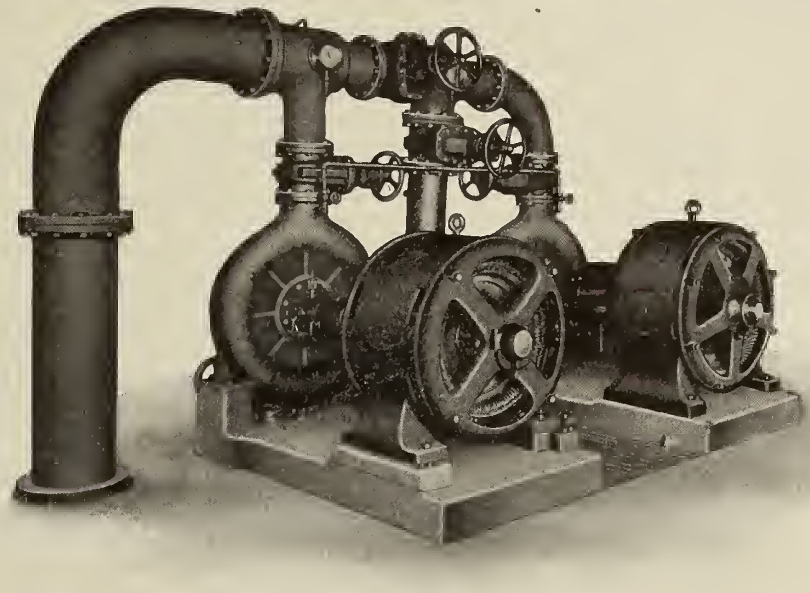

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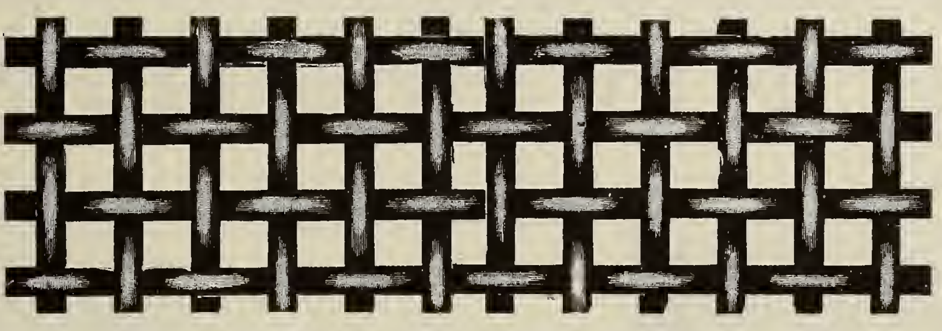

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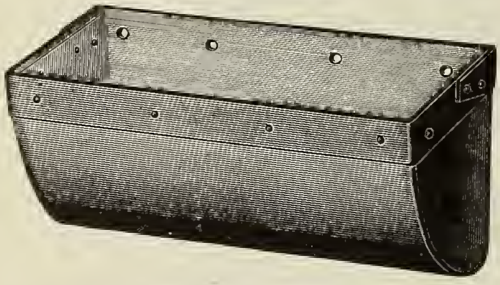
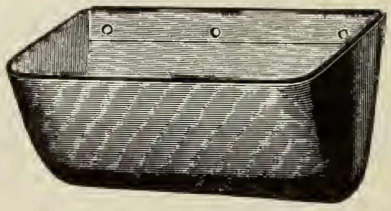


Buffalo Elevator Bucket



Salem Elevator Bucket

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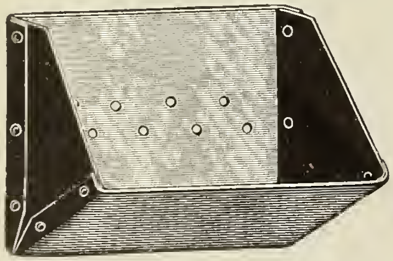

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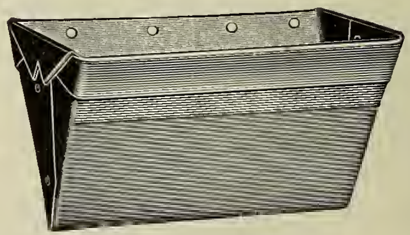

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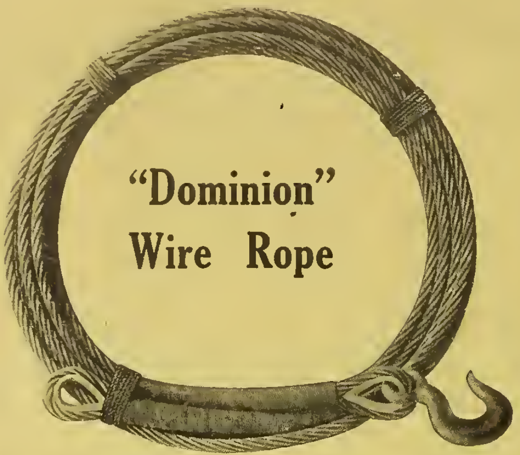

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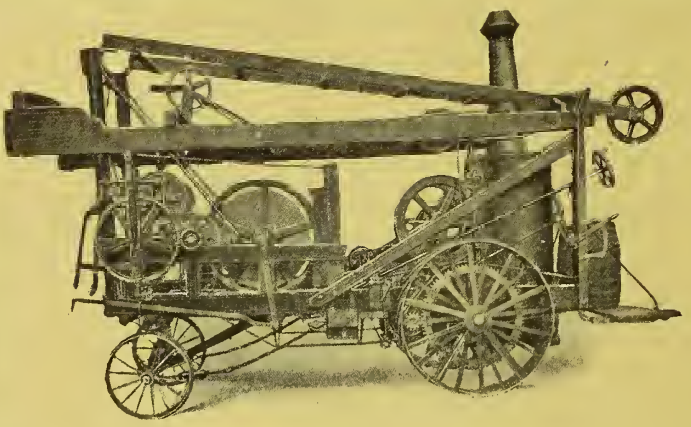

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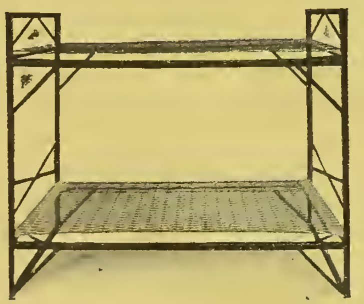

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Vol. 28 Toronto, September 30, 1914 No. 39

Contract Record and Engineering Review

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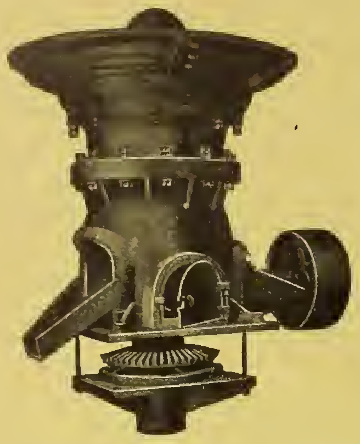

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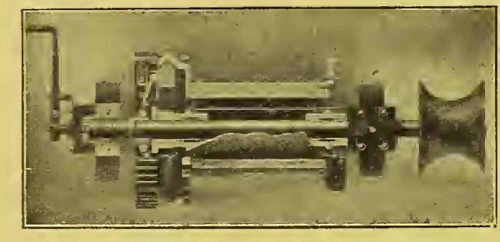

Suppose you were engineer of a hoisting engine, operating a clamshell bucket or running a derrick that required fast, continuous work, which would you prefer—an engine with an easy operating friction; easy to throw in, easy to hold in, or one with a friction that required violent effort to throw it in and equally violent effort to hold it there? That's the difference between

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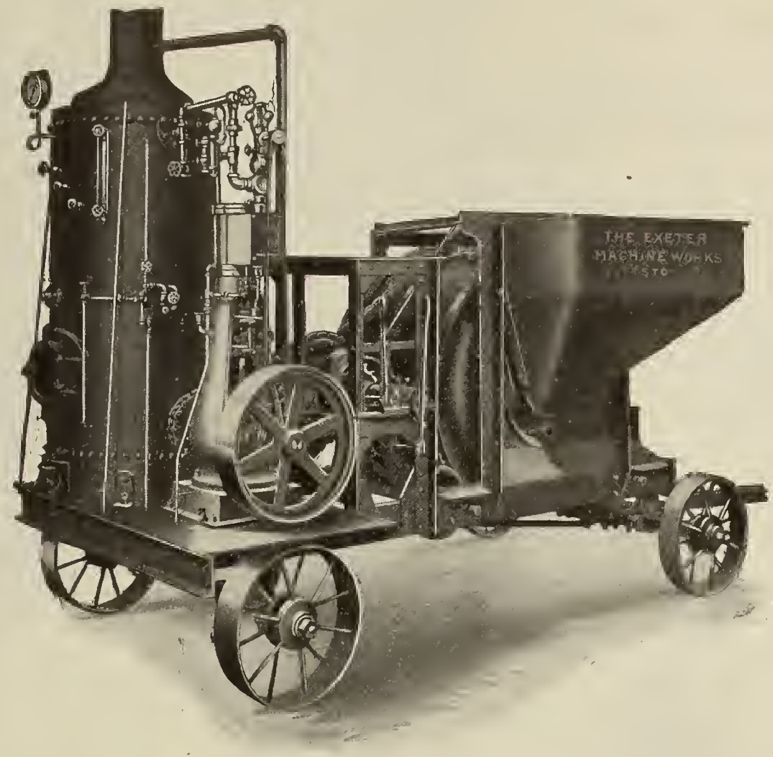
Improved Concrete Mixers



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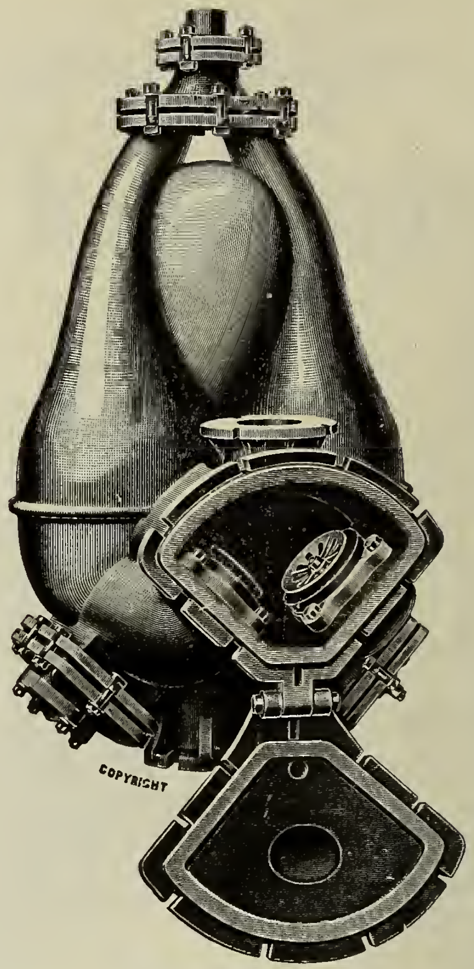

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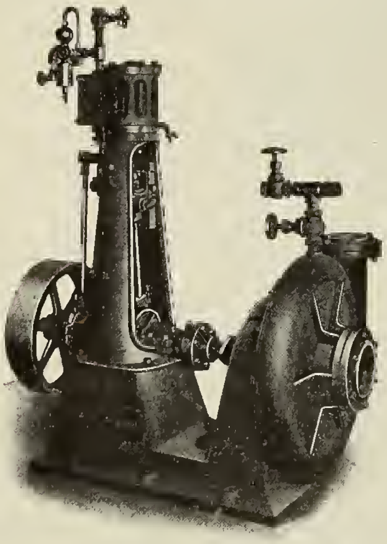

Swaby Centrifugal Pump with Steam Engine

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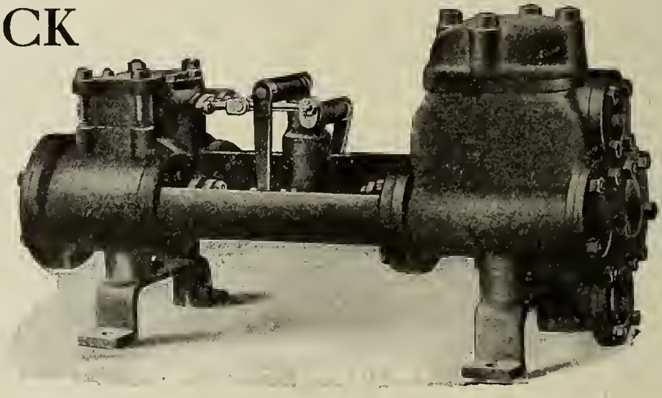

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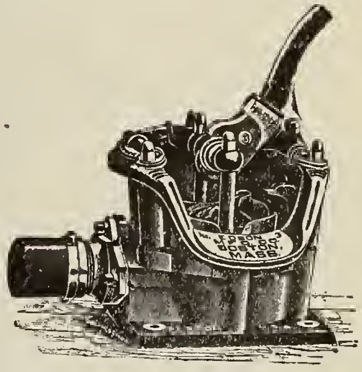
CALGARY, 10th Ave and 3rd St. East
COBALT, Opp. Right of Way Mine
VANCOUVER, 101 Water St.
QUEBEC, 142 Peter St.
HALIFAX, 78 Granville St.

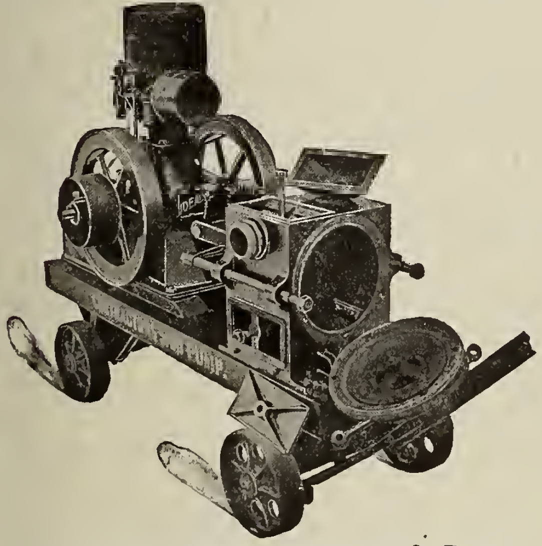
SEWAGE
AND
TRENCH PUMPS

Novo Trench Pump, on Trucks, with Gasoline Engine.



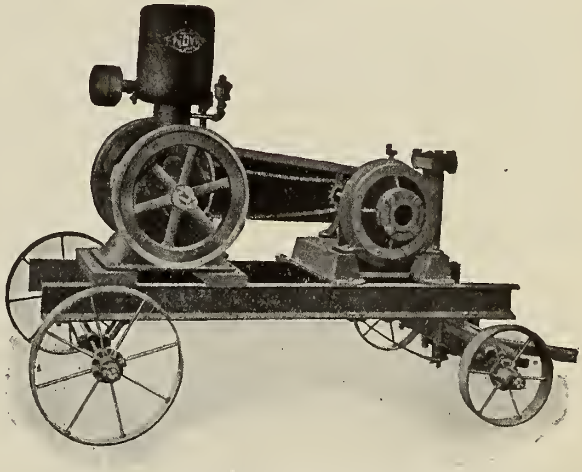
Edson Diaphragm Pump.

These Pumps are guaranteed to pump water containing gravel, sand, mud and sewerage.



Parker Double-Acting Trench Pump.

Hand and Gasoline Pumps, Single and Double Acting



Novo Centrifugal Pump, on Trucks, with Gasoline Engine.

Carried In Stock.

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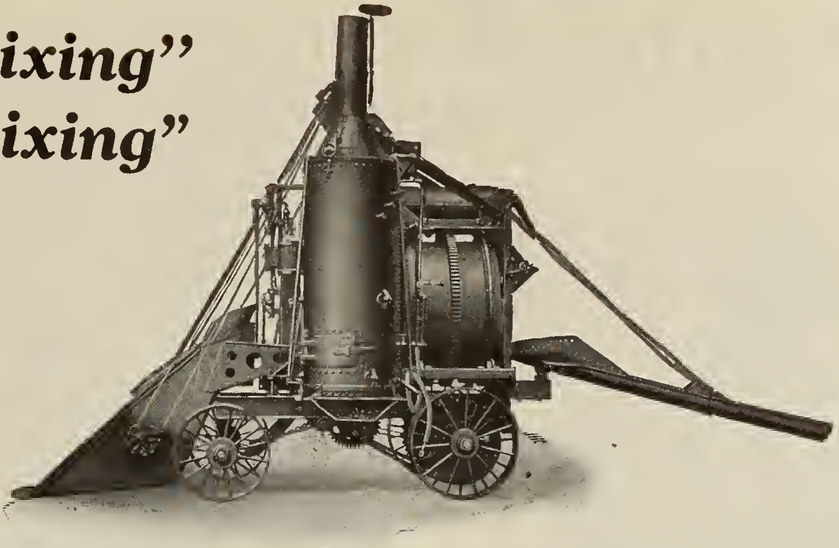
Canadian Ingersoll-Rand Co.

(Continued on page 12)

"Most Mixing"
"Least Fixing"



M-C Rail-Track Paver, Showing 8 ft. Distributing Chute, for Roads and Street Work.

M-C Rail-Track Paver

Points too valuable to overlook Compare them with those on other machines. That's all we ask.

Traction	12 horse-power steam or gasoline engine; Two speeds ahead, one speed reverse; Heavy brakes like on auto trucks; Powerful differential; Extra large wheels; Right height to pass under city viaducts; Drives like a traction engine, up hill or down; Sell your horses—you don't need 'em.
Operation	Perfect one man control; Engineer works in one natural position; No stooping or stretching; Engineer rides when traveling; Levers all at fingers' ends; No expert needed to handle distributer; Safety first—gears covered.
Capacity	Continuous mixing; 11 to 12 cu. ft. of wet mixed concrete, or 2 bags 1-3-5 per batch; Daily capacity, 1200 to 1400 street yards, 6 ins. thick.

Mechanically, the M-C Rail-Track Paver is as well built as we know how to build it. It has all the strong features of the M-C standard mixers:—**Semi-steel Drum, Steel Rail Tracks; Segmental Gear; Dustproof Roller Bearings, Etc., Etc.**

Send for free catalog explaining it in detail

CANADIAN FAIRBANKS-MORSE CO., Ltd.
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C. P. R. OFFICE BUILDING
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Two prominent corners in Toronto

The Terra Cotta for both buildings was manufactured and set by

THE NORTHWESTERN TERRA COTTA COMPANY

Chicago - Illinois

Agencies in all the large cities of Canada.

The Fire Department of New York City Uses Ceresit on an Important Job.

CERESIT
TRADE MARK

The water gate walls of the High Pressure Pumping Station, New York City, (shown above) were waterproofed with Ceresit.

Ceresit is as dependable a waterproofer for cement under conditions of extreme hydrostatic pressure as it is under conditions of moisture or light ground water pressure.

Write for our 1914 "Book of Evidence."

Ceresit Waterproofing Company

913 Westminster Bldg., CHICAGO

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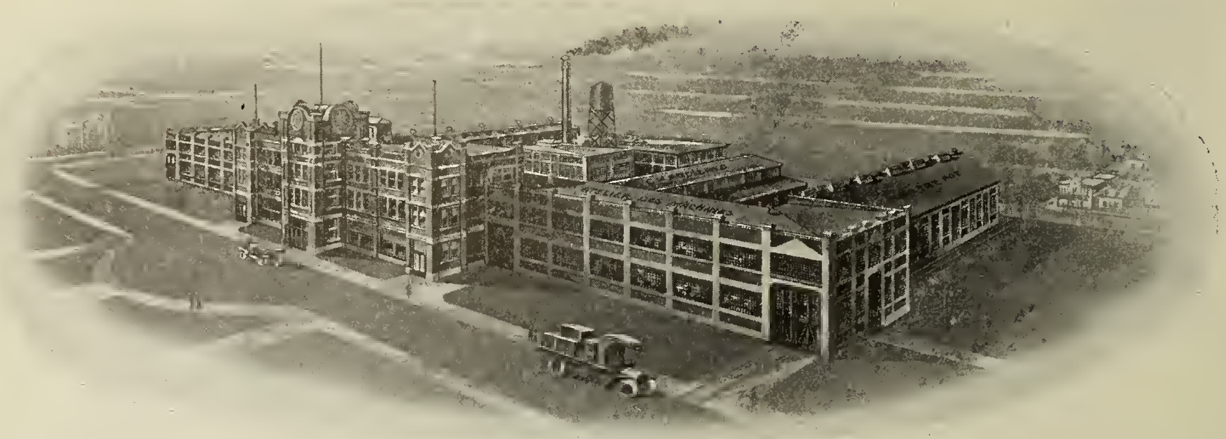
High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CANADIAN LOCOMOTIVE COMPANY, LIMITED, KINGSTON, ONTARIO, CANADA

TAYLOR & ARNOLD, LTD., Sales Agents, MONTREAL and WINNIPEG



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"Montmagny" Modern Road Builders

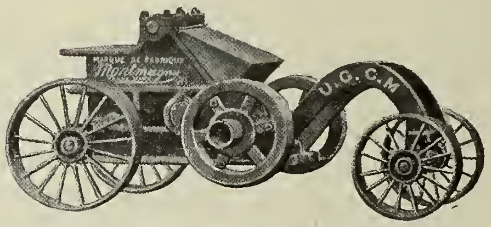
WE are the only firm in Canada specializing in Road Machinery and making the complete outfit.

The "**Montmagny**" line includes every machine necessary in good road construction.

The machines are specially designed for this work and are making good on roads in every part of Canada.

Write us for Catalogue

"Montmagny" Steam Road Roller.



"Montmagny" Stone Crushers.

"Montmagny" Portable Steel Bin.

Road Roller

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

A great feature "Power Steering"

Stone Crusher

The "Montmagny" stone crusher is an all-steel machine designed and built to produce the greatest output. Points that are weak in other crushers are strong in the "Montmagny." No heating parts. Entirely dust-proof and all working parts easily greased or oiled.

Steel Bin

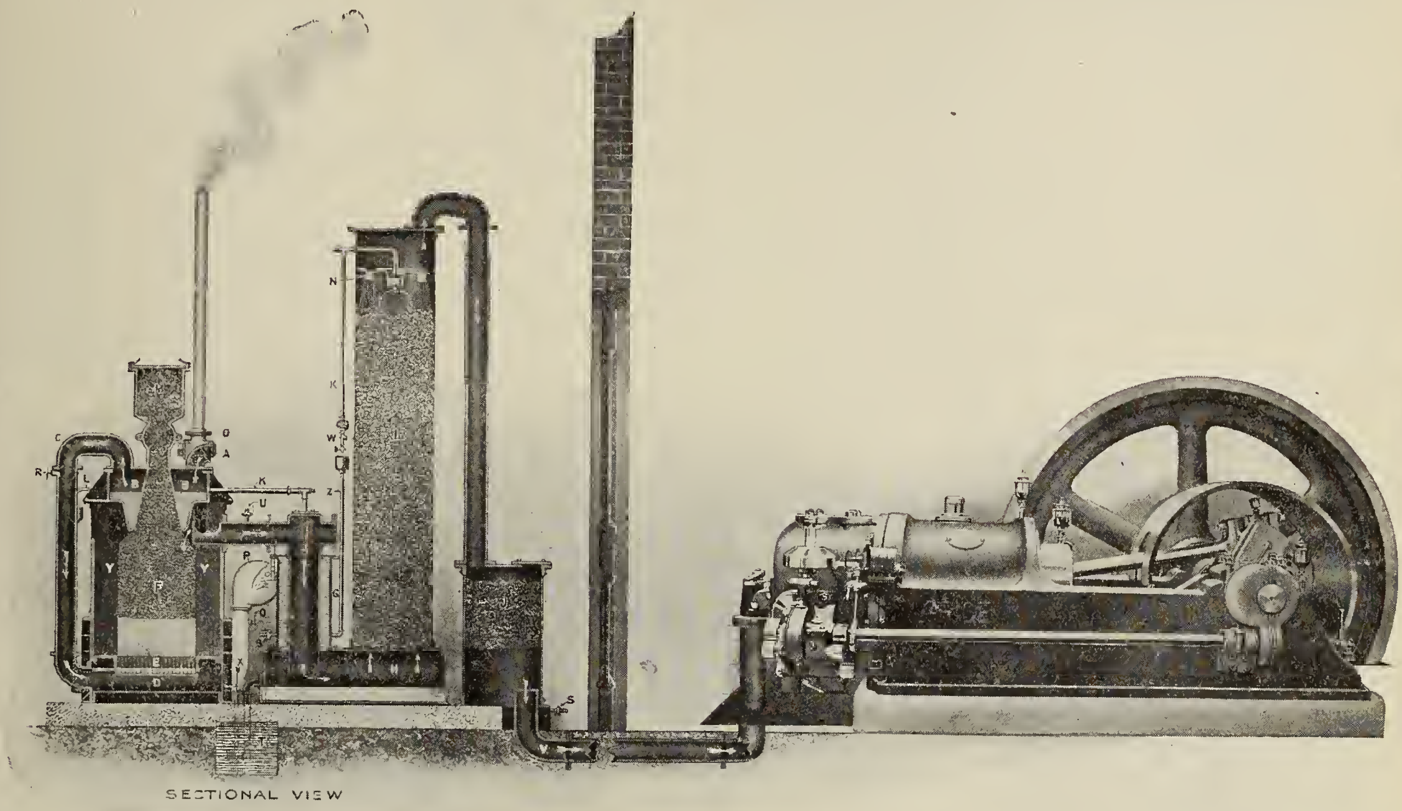
The "Montmagny" steel bin is designed for convenience, strength and lightness. It is made in two sizes. Inside partitions separate the different sized stone. The machine is easily portable. The Elevator is all-steel and double chain.

General Car and Machinery Works, Limited

Quebec **MONTMAGNY, P.Q., Can.** **Montreal**

GAS ENGINES

For Operating on Suction, Town or Natural Gas



Engines made in all sizes up to 300 B. H. P.

Suction Gas Plants for operating on
Anthracite, Coke or Charcoal

Thousands of these engines and gas producers, working successfully all over the world.

George Anderson & Co. of Canada, Ltd.

617 Quebec Bank Building, MONTREAL

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  - Morris Hoist & Crane Co., Herbert.
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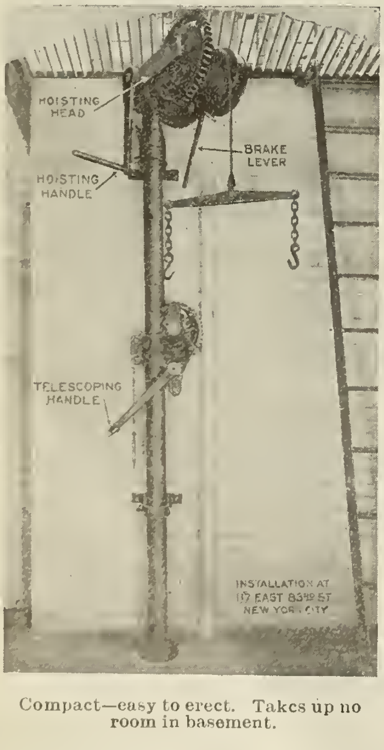
  - Rock and Power Machinery
  - Royce Limited

(Continued on Page 14)

G & G TELESCOPIC HOIST (PATENTED)

With compound gear and brake attachment

for Hoisting and Lowering Ash Cans, Kegs, Barrels, etc., from cellar to sidewalk.



Compact—easy to erect. Takes up no room in basement.

1.—It is telescopic—no part showing above sidewalk when not in use.
2.—Takes up minimum space in areaway or cellar, the opening in sidewalk need be little larger than necessary to permit passage of can.
3.—Simple in construction and absolutely rigid when erected.
4.—It is made of strongest and most durable material.
5.—Compound gearing is provided in connection with both the handle that telescopes the apparatus above sidewalk, and the handle that raises the load to the sidewalk.
6.—A powerful ratchet device is provided with both handles above mentioned.
7.—A powerful all-steel brake attachment permits perfect control when lowering heavy loads.

Maximum working capacity, 500 lbs. Hoisting Handle does not revolve when load is being lowered. Raises load at speed of 30 feet a minute. The position of operator, standing at sidewalk when hoist is in use, protects the public against danger of falling into shaft; and protects operator against danger of heavy load falling on him.

Gillis & Geoghegan
549 West Broadway
New York

Hoisting head revolves. Can is deposited on Sidewalk without lifting.

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Agents for Quebec
Montreal

W. T. Grose
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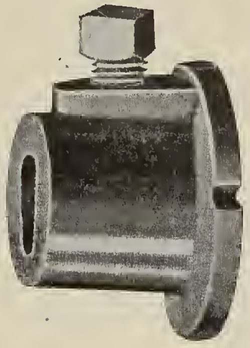
Winnipeg

Wm. N. O'Neil Co., Ltd.
Agents for British Columbia
Vancouver

Universal Form Clamp



Secured to the ends of round rods passed through your forms, these inexpensive clamps hold the centering rigid, resisting a strain exceeding the tensile strength of the steel rods themselves.

Clamps are easily applied, adjusted and tightened. A wrench releases them. Pull the rods out of the concrete with our Rod Puller.

Write today for Circulars and Prices

Railway Contractors Supply Co.
Standard Bank Building, Toronto
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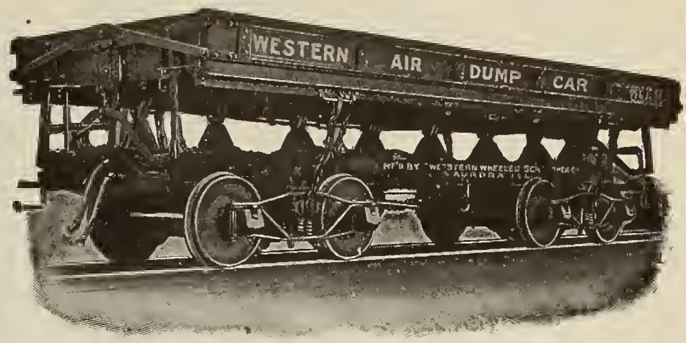
—Montreal representatives—
RAMSEY & KELLY, 511 Quebec Bank Building

Western Air Dump Cars



You make money when you keep your men and equipment moving. For continuous service, Western Dump Cars cannot be excelled. It frequently happens that the cars which are used on important work must operate under difficult conditions. Here is where the selection of the right car may prevent a loss and make a profit. Contractors who know, depend on Western Cars when they want to play safe. Successful men on all kinds of construction work are users of

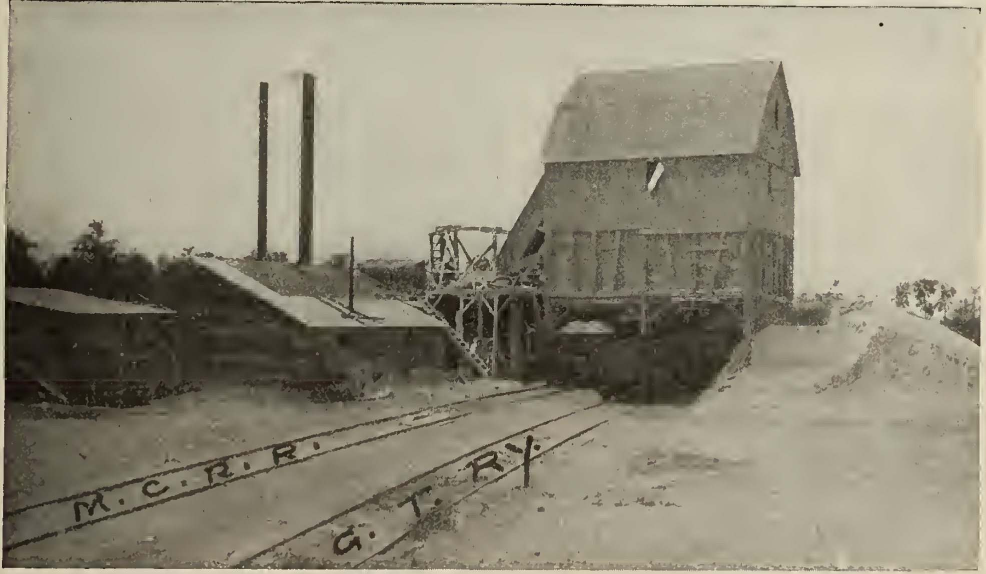
Western Earth and Stone Handling Machinery.

Catalog will be gladly sent on request.

Western Wheeled Scraper Co.
AURORA, ILLINOIS

Dominion Equipment & Supply Co., Winnipeg, Calgary, Edmonton
Agents for Manitoba, Saskatchewan and Alberta
Canadian Equipment Co., Montreal, Agents for Eastern Canada

Macadam Roads



must be built of a

Tough Stone

that will cement

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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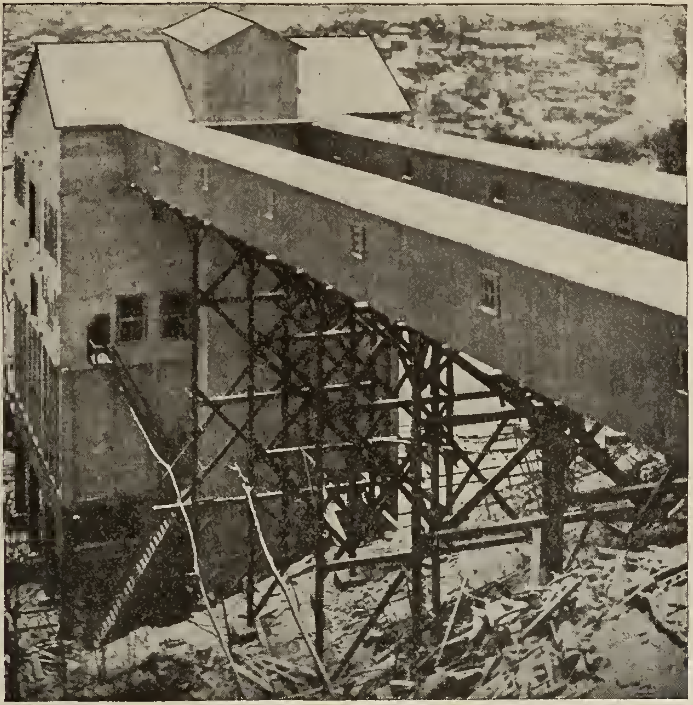

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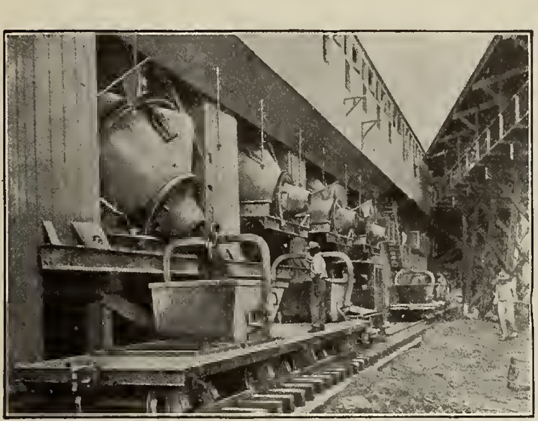

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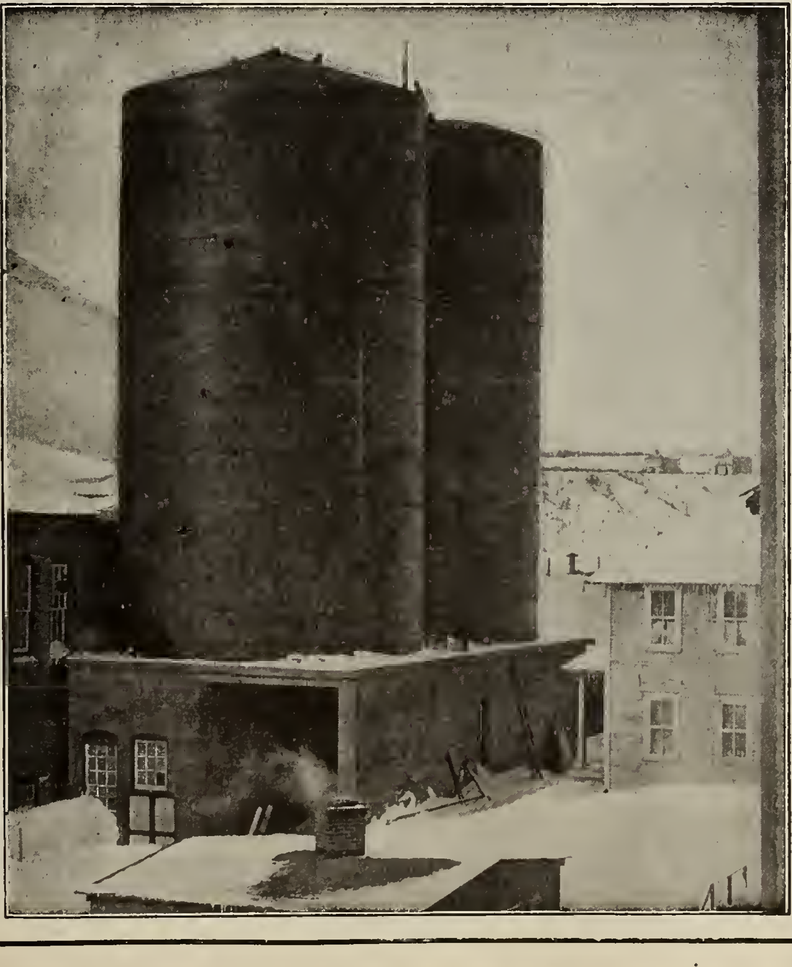

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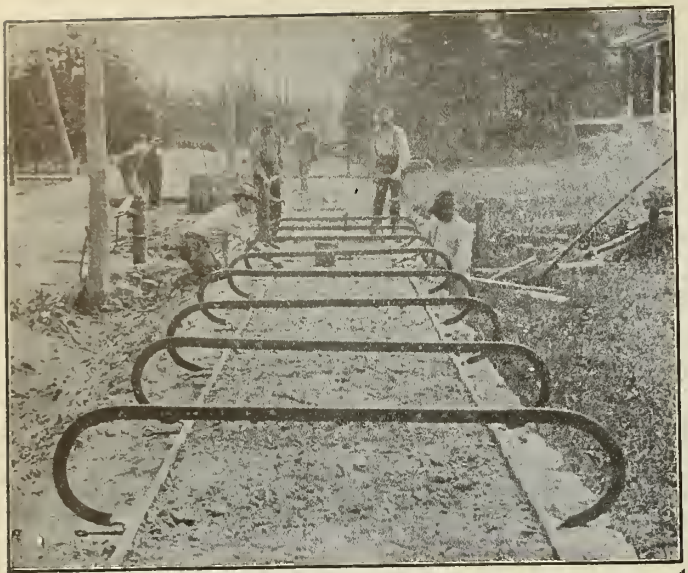

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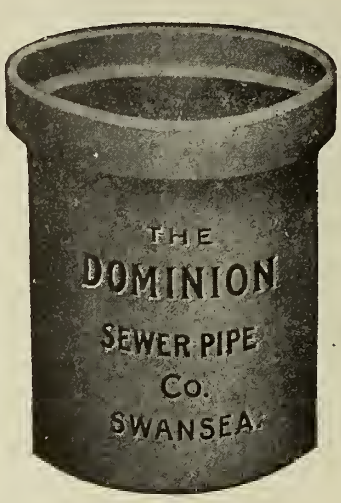

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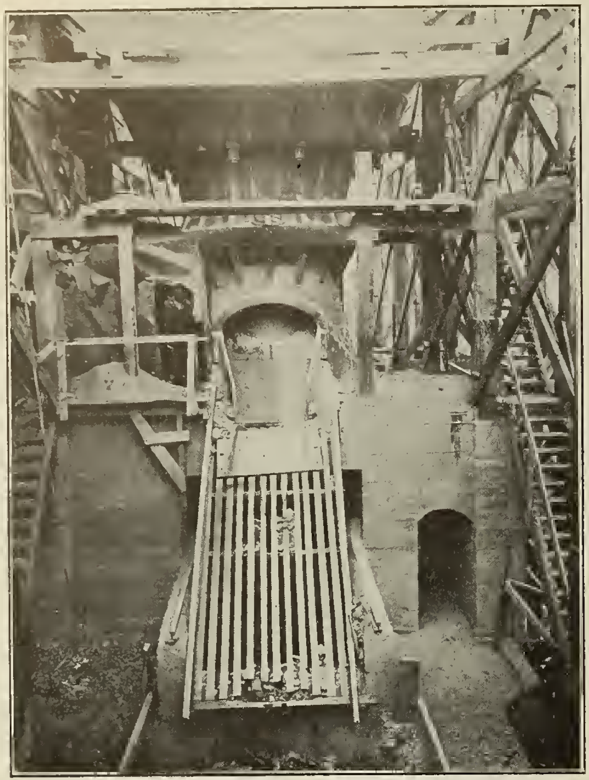

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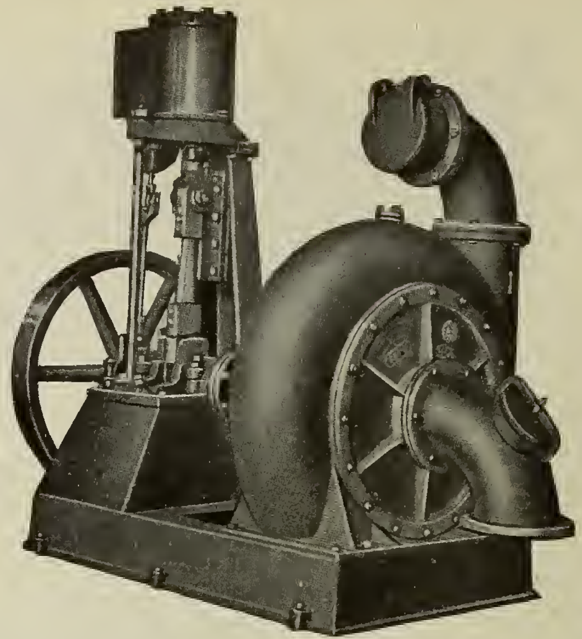

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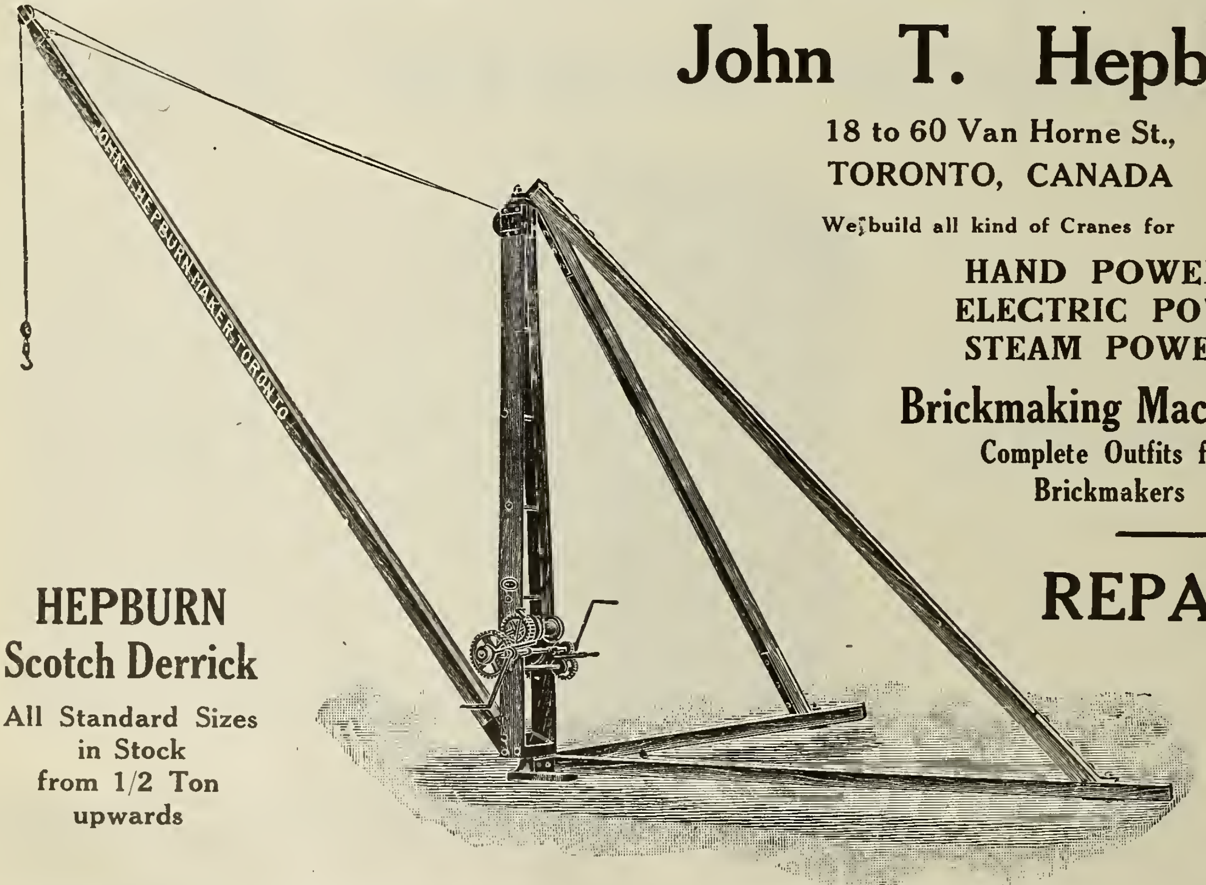
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The BROWNHOIST Locomotive Crane
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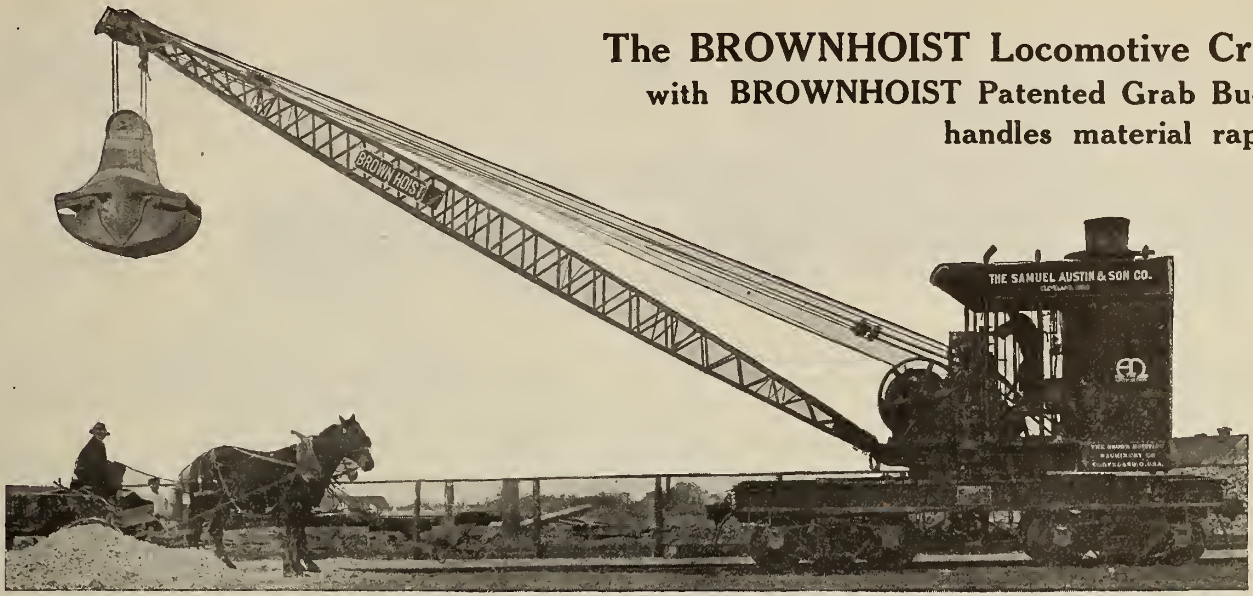

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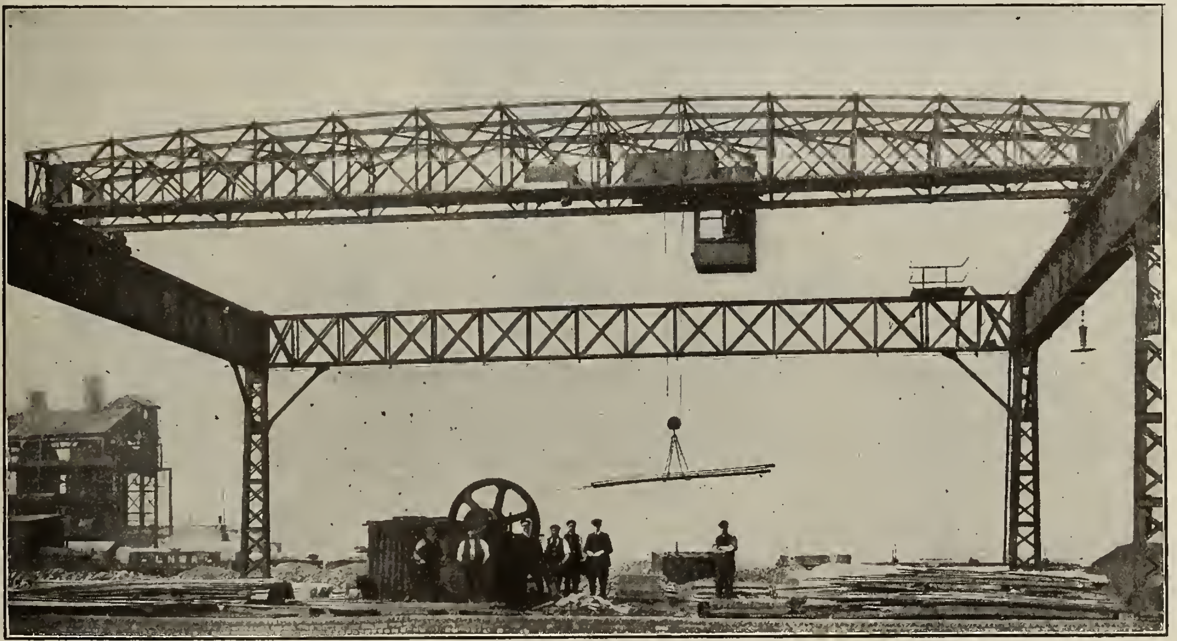

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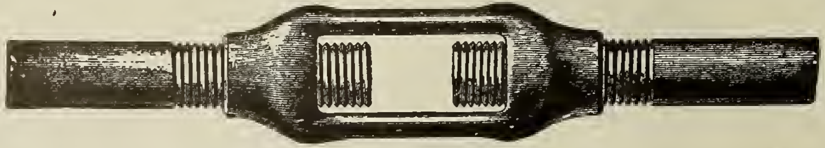

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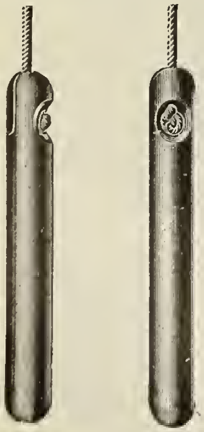

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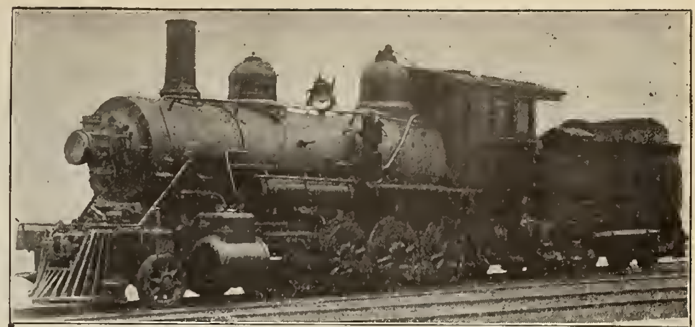

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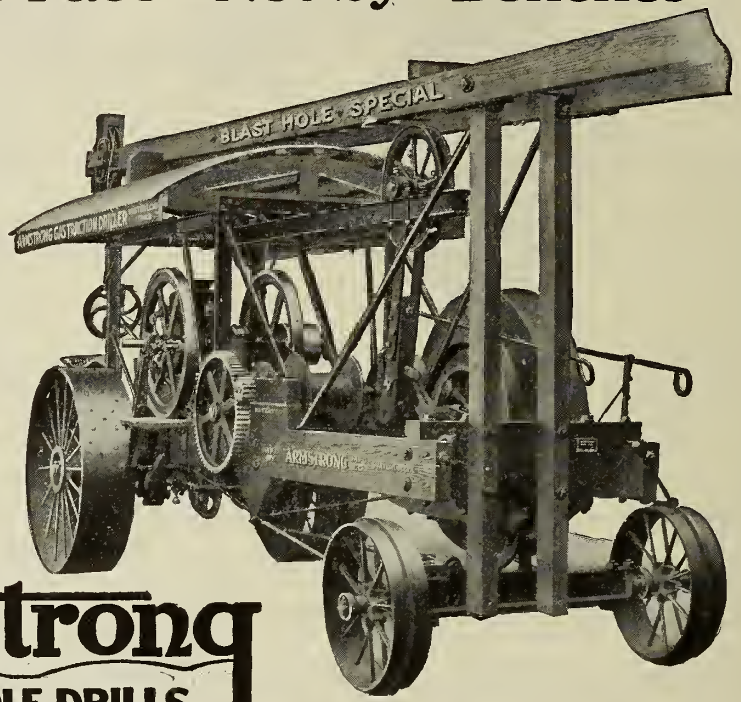

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Dartnell, Limited, Montreal
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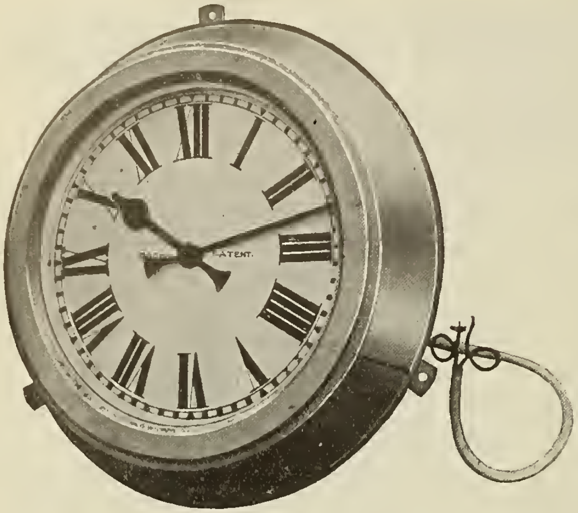

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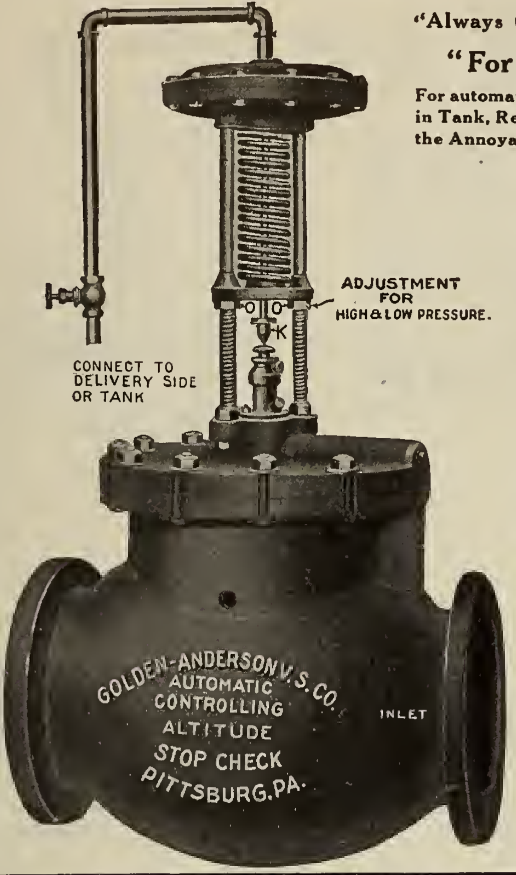
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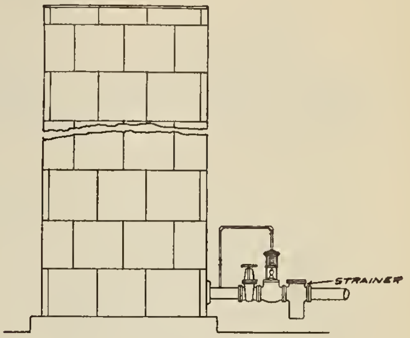

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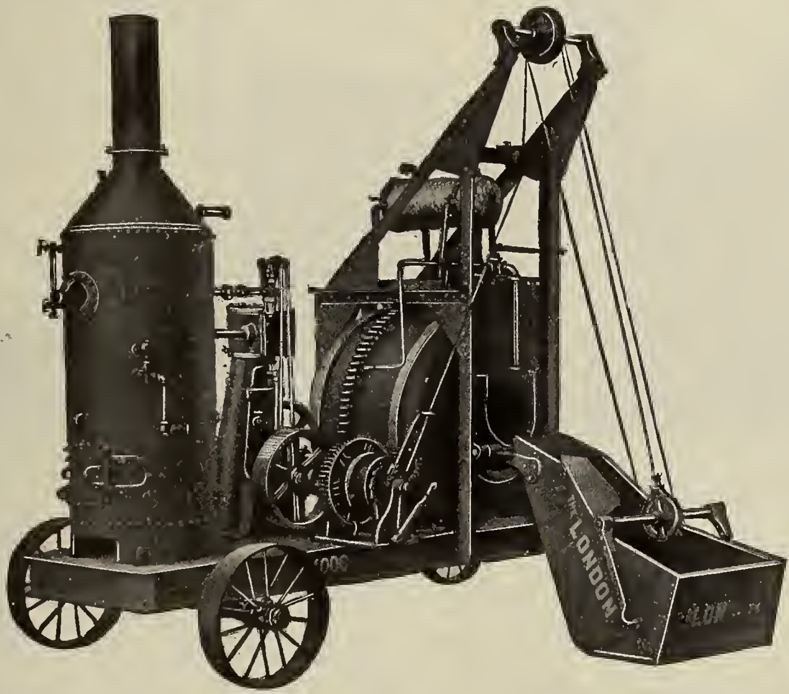

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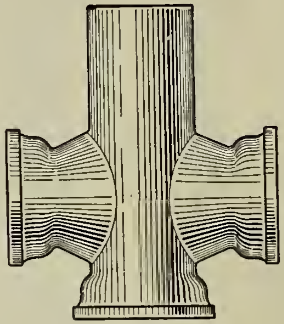

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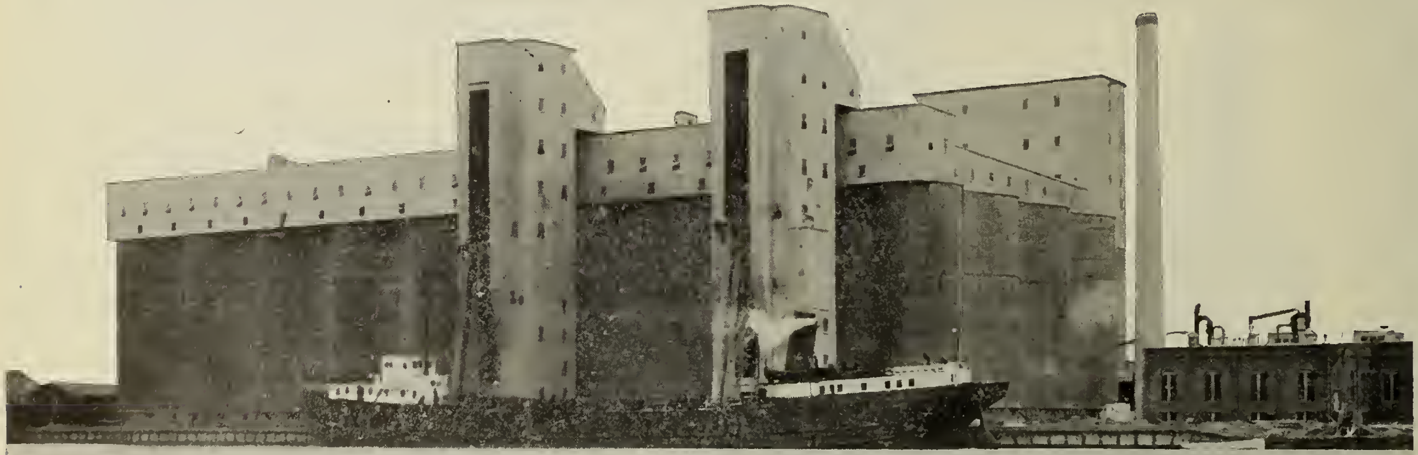

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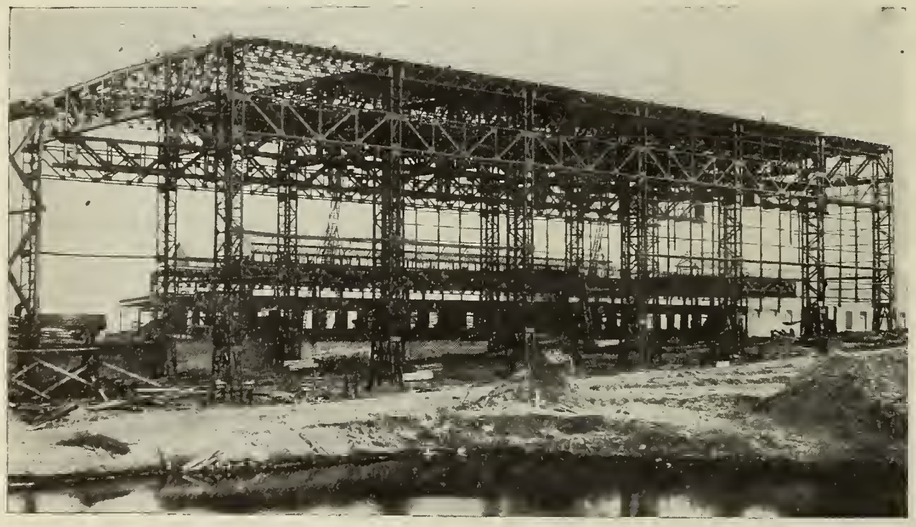

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An Eye Beyond the Immediate Future

ONE cannot emphasize too strongly the necessity of our taking careful stock of the European situation. Whether we like it or not we shall be forced to take part in the general adjustment of British trade which will follow the cessation of hostilities. We may rest assured that there will be no compromise with German manufacturers. At present, be it said, it is unlawful for local authorities in any part of the Empire to trade with the enemy, and it is safe to assert that the embargo on German trade will be relaxed very gradually in our day and generation. Great Britain will be slow to forget how she once contributed to the upbuilding of a great German army by purchasing German manufactures and materials freely—how she contributed to developing the sinews of war at the cost of her own industry and at the cost of thousands of lives.

Few people in Canada know the extent to which British industries have been over-run by the Germans. Some of the most flagrant cases have been held up lately before the public of the old country. Two of the examples given are the London Asphalte Company, Limited, and the British Ceresit Waterproofing Company, Limited. The directors of these concerns are as follows:

London Asphalte Company, Limited.

Carl Henitz, 244 Goltsteinstrasse, Cologne.
Leo Jacob Tutt, Finsbury-Pavement House, E.C.
Ernest von der Wettern, 5 Uriel King, Cologne.
Alexander Ruthemeyer, Wiesbaden.
Gustave Utz, Wiesbaden.
Emil Ruthemeyer, 15 Almirfelstan Grosse, Dusseldorf.

British Ceresit Waterproofing Company, Limited.

Eric von Schwarze, of London.
Leopold Heppe, of Unna, Germany.
H. Von der Heide, of Unna, Germany.
Otto Funcke, of Hagen, Germany.

This sort of thing will be tolerated no longer. Germans parading under the cloak of British industry and assuming British names will stand no more chance than a German spy disguised in British uniform. Germany itself has shattered the great trade which in a few spectacular years it had established in a position approaching supremacy. The German has got to go, bag and baggage. Whether he be a victim of the Kaiser's system or not, British public opinion will not tolerate him. No weak-kneed plea that the German people had no part in the organized conspiracy against Great Britain can be accepted. Such acceptance would be to mock the brave men who are giving their lives in defence of Empire. For years the German will remain an unsavory reminder of the bloodiest and most wanton iconoclast the world has ever known.

In Great Britain, therefore, undoubtedly there will be a great revival in British-made goods, and in this revival Canada will have a proportionate share. With a renewal of constructional activity in the Old Country, there will be a greatly increased demand upon the British manufacturer. Part of this demand will be diverted to Canada and within a few years we shall see many of the leading British firms establishing branches here. They will be confronted with a growing demand at home and they will have to meet orders from Canada and other parts of the Empire—and the expansion cannot be confined entirely within the "right little, tight little island."

In some of the diverted export trade our neighbors to the south will have their share—and they will have it ungrudgingly. A case in point is Germany's export to Great Britain of an enormous annual tonnage of cheap steel at prices which cannot be approached by British manufacturers, even with their commonest brands and at the sacrifice of all profit. Now, owing to the cessation of imports from Germany, British manufacturers in this field are coming into their own and in short order we shall find the United States in possession of at least a portion of the surplus trade.

Another phase of the question is that British industry must be prepared to make a swift bid for the trade with other countries which Germany will lose. Take, for example, Japan, with whom Germany is now at war. One will hardly question the assertion that German-made goods will be tabooed by the Japanese. What, then, is to take the place of the manufactured articles which Germany has been sending in to Japan with increasing activity year by year? Last year Japan imported German products to the extent of $34,000,000. This compares with British imports of $61,000,000 and United States imports at practically the same figure. Will Canada have no share in the re-adjustment of Japan's thirty-four million dollars' worth of German imports? Take machinery. Japan must continue to import machinery on a large scale, for in spite of her great industrial progress she will not be able to compete successfully with European and American manufacturers in these lines for many years.

Then there is South America. The opening of the Panama Canal cannot fail to enhance greatly the opportunities for the British exporter, and Canada must share in the gain which will come to North America. By far-sighted business men great interest is being taken in the possible openings in South America suggested by the disappearance of the German mercantile marine; and here, almost at our doors, we may look for a fresh field of industrial conquest.

To speak of industrial conquests by Canada would appear to some people to be visionary, in view of the character of the home demand, but looking ahead with an eye to opportunity one must be visionary. Canada has opportunities in prospect which it is impossible, at the moment, to estimate. All that we can do is to look with reasonable certainty to the time, not so far distant, when the patient beginnings of private enterprise have developed into great national undertakings whose ramifications extend to the uttermost parts of the earth. Well may we commit ourselves to a policy of active, though conservative, business confidence during the period of conflict, having reasonable assurance that the British Empire will emerge from hostilities purged of a foe menacing and ungenerous alike in peace and war.

The Genesis of Design

IN a state of order, all things stand in reciprocal relation; law connects part with part, and part with whole. In practical design our drawing-boards insure, mechanically, correlation to a certain limited extent; for each horizontal drawn with tee-square is true to base, each vertical is at normal angle. In earlier days, no doubt, the designer wanting accurate mechanical aids would have needed to exercise his mind in maintaining true horizontal and vertical, just as the mason constantly applies line and plummet. It may be that this necessity for continual vigilance gave a certain nobility to the work of the designer in primitive times; that his self-reliance was fostered, and forcefulness and character were engendered. We need but casually look round to assure ourselves that our present-day excellence of instrument and appliance does little to open the eye to an understanding of true symmetry and grace of form, for assuredly we see no end to the production of disorderly and warped architectural mass. We may agree that the basis of design is order, and that order means correlation of part; but the worship of the so-called picturesque in place of quiet dignity, shows that in practice we frequently ignore fundamental principles to which, in theory, we profess allegiance. This is a matter of regret, since if we earnestly seek some main guiding rule in design, we may find it in the principle of correlation, whereby each thought and act in design has definite relation to some over-ruling master idea. Holding to this principle, we may be saved from wanton acts, destructive of unity, and make each thought observe a general thesis. Each act of design is then comparable to a line drawn with tee-square; it is made true to a base. In the sum, such acts correlate, are laid, as it were, course on course, to line and plummet.

If we inquire why mere geometrical correlation, mere placing of objects at equal distances, at certain angles, on certain balanced curves—why parallelism, co-ordination and concentricity alone, of themselves are causes of interest to the eye and convey a sense of beauty, we shall find these questions in great part answered, if we consider correlativeness as the essence of order, and order the genesis of design. Each part has reference to other; the whole is bounded and bonded by a common, all-dominating law. Whether it be jewelled pendant, concentric circle in rain-splash and ripple, or iso-curving wavelets in a wide-sweeping bay, beauty in major part seems to reside in the sense of order, the existence of law, and the general subservience of part to whole effect. Geometry, as such, we may conceive to have no aesthetic import; but geometry as signifying law and order, and as indicating reciprocal relation of part, such as we see demonstrated in equidistant columns and the regular spacing of flutes, is no doubt the hidden cause—the fount and origin of beauty in architecture.

Geometry, as a concrete expression of order, appears rather an attribute than an entity in architecture. The display of severe elemental geometric form itself is not the aim. The orderliness and correlativeness of geometry runs through and through architecture as bond-entwining correlativeness—order; but if the end and aim of architecture were merely the exhibition of geometrical form, as such, and the ultimate effects were governed by this, plain iron sheds would be types of architectural beauty! When, therefore, we set so much store on order and correlativeness and the super-domination of the geometrical, we refer rather to an invisible warp and weft intermeshing and bonding part and part into unity.

There may be nothing of special interest, and obviously no novelty, in displaying the circle, as such; yet all objects of art founded on the circle possess its inherent beauty, and have an interest born of outcoming from—the circle. The relation of part to whole—the correlation, or sign of order, is here at its simplest; all refers to a centre, be it ring, wheel-window, or round moon. In the wheel-window the mullions may radiate, bringing another feature of design under one law; but the wealth of varied interest that the Mediaeval builders threw into circular windows shows that, given the circle as frame, the greatest prodigality and play of line and curve, within the circle, do but add gravity to effect. This is but natural, and an affair of mutual enhancement. The four straight and square lines that define a marble panel are the foil and contrast whereby the utmost value is given to all its natural, asymmetric markings and figure.

These considerations suggest that even order—correlativeness—needs some counterfoil; that is to say, reciprocal relation may be heightened in value by the juxtaposition of something akin to disorder. It seems almost impossible to employ such a term in design; but wild asymmetry, as the figuring of marble, does unquestionably derive increased value from close proximity to severe and simple geometrical lines. We must allow a place in architecture to the grave and gay, just as we employ the bass and treble in music. If we give too great heed to geometrical disposition; if our design is all right lines and right angles, we gain dignity, but lack variety. For the designer, this is a consideration of importance, for it shows that even order itself requires foil or contrast, and that the plumb and square parts of ruined architecture appear more so in the face of decayed and crumbling litter; and the spirit of the same principle we may see where right-angled leaden lights frame and empanel lace curtains and the flowering plants of cottager's window.

The principle of correlation induces us to render more pronounced and apparent geometrical form; but the need for variety and foil warns us not to carry the rule too far. If we never go outside our principle, or rather, if we never allow a little play or fancy and abandon, all lightness—the magic and charm of variation—would be stifled. All we need to see is that the change and variation does not occur in weighty matters; that we do not play with form in grave and serious main masses of building. It is in careless treatment of such building masses that want of respect for our principle of correlation—want of a high sense of order—is mainly evidenced. In the preservation of simple mass resides dignity. If we believe that order is reciprocal relation of part, we shall carefully avoid senseless break and change. Looking back into the ages, we shall find ample confirmation in support of these views. All great works convey an impression of a high sense of order, of over-ruling law, and, in each, a dominating theme or idea, to which every thought and effort of the designer has been subservient.—Building News.

Big Business of the Nations

The United Kingdom has a foreign trade of $6,830,000,000, its imports are valued at $3,741,000,000, or $652,000,000 in excess of all exports, domestic and foreign. Germany in 1912 had a foreign trade of $5,059,000,000, imports being $2,754,000,000, or $449,000,000 in excess of all her exports. France showed a total trade of $2,884,000,000 in 1912, her imports exceeding her exports by $293,000,000. The United States for the year 1913 had a foreign trade of $4,277,000,000, her imports being $1,793,000,000, and exports of domestic and foreign goods (chiefly domestic) being $2,484,000,000.

Loss of German Products

OUR New York contemporary, the Engineering News, waxes somewhat pessimistic in regard to the loss of German products. We reproduce an editorial which appeared in a recent issue of the News and invite readers of the Contract Record to send us an expression of opinion as to supplementary sources of the supplies the loss of which our contemporary deplores.

"It is only giving credit where credit is justly due to say that there is probably no other nation in the world whose sudden isolation commercially would cause such widespread loss as has been caused by the isolation of Germany. It is appropriate that this should be recorded here because Germany more than any other nation has won its important place industrially, not by reason of its wealth of natural resources or its geographical location, but by the skill and intelligence with which its people have attacked modern technical problems.

"While engineers and chemists are generally aware of Germany's leadership in the field of science and technology, the events of the past few weeks have been a great object lesson to the general public. Few have realized the extent to which the whole world has relied upon German scientists, chemists, engineers and manufacturers, for the supply of many materials necessary in the arts. Manufacturers in America and in England who were congratulating themselves on their enlarged opportunities for foreign trade in markets where the supply of German goods was cut off have in not a few cases found their own productive operations seriously hampered because they could no longer obtain certain materials from Germany.

"As is well known, steel manufacturers were greatly worried to know what they were to do for their supply of ferromanganese. Manufacturers of fertilizers have had to face the possible shutdown of their works through the cutting off of the supply of German potash. In the textile industries, manufacturers suddenly realized that with access to German ports blockaded by warships there was every prospect that the supply of dyes and dyeing materials would be seriously interfered with. In the drug and chemical trade, prices doubled and trebled when it was realized that with further supplies from Germany cut off, the world would have to get along for a time without certain drugs and chemicals which have become well nigh essential both in the pharmacy and in certain industries.

"The above list might be greatly extended. It is in fact only a statement of a few of the important staples, in the production of which Germany has been so pre-eminent that all the rest of the world has relied upon her to furnish them.

"Surely, from a broad point of view, the victory which Germany has gained over the nations of the earth by its leadership in the conquest of the most difficult fields of industrial technology actually surpasses as a meritorious achievement any victory which its great military organization may gain by brute force.

"It is said that most of these things for which we and other nations have been accustomed to rely upon Germany, could be produced here if necessary. This is true as relates to most of the materials, provided sufficient time were available, but sufficient time in most cases is a very long time. In the fertilizer trade, for example, investigations have been in process for a number of years looking to the production of potash from natural sources in the United States. But what has been actually accomplished commercially is the merest trifle compared with the demand which must be supplied. To develop plants which will produce the amount of potash required by the fertilizer trade and other consumers in the United States, and at a cost consistent with commercial necessities would require not months but years. Farmers and fertilizer manufacturers are anxious to know what they are to do in the meantime.

"The same thing holds true of numerous materials in the dye and chemical trades. Physicians and druggists accustomed to use some of the varied products of coal tar, most of which have originated in and are solely produced by Germany, are in a quandry to know what they can do if the source of supply is entirely shut off.

"It is of particular interest to note, moreover, that the manufacturers of England, Germany's great commercial rival, and present enemy, are almost as badly hit as those of the United States by the cutting off of the supply of German products. Our English exchanges reveal that while English manufacturers are making large plans for capturing the export trade in many lands which Germany cannot now reach, they find themselves handicapped at every turn by the cutting off of supplies which they themselves have been accustomed to obtain from Germany.

"Fortunately, the war has not yet closed all the avenues by which Germany can send out its product to the world. Through Holland, a neutral nation, shipments from Germany can reach tidewater and be distributed by neutral vessels.

"Of course, the drafts on Germany's male population for the army have paralyzed a large part of Germany's industrial activity, but since an underlying motive of the war is the maintenance of the nation's commercial prestige, it cannot be doubted that Germany will use every effort to continue to supply her foreign customers, so long as any channels for the outlet of her exports remain open."

Rebuilding the Pitt River Bridge

DOUBLE-TRACKING the lines east from Vancouver has necessitated the rebuilding of all the C. P. R. bridges. The largest of these in British Columbia, the one crossing the Pitt River, located about twenty miles from Vancouver, was the most difficult one to construct. Pitt River is about ten miles long and is the outlet of Pitt Lake into the Fraser River. The C. P. R. crosses it about one mile above its confluence with the Fraser, and the river at this point is about 1,800 ft. wide.

The old bridge consisted of seven fixed spans and one drawspan, and about 600 ft. of pile trestle. When the piers for the old bridge were built, the river scoured out a great deal and consequently an unusual amount of heavy riprap was required both in the river bottom and around the piers. This was a very serious drawback in the sinking of the new piers, especially with the open caissons which were dredged down.

The new bridge will consist of eight 80 ft. plate girder spans; one 279 ft. drawspan; two 257 ft. and one 182 ft. trusses, totalling 1,750 ft. between ballast walls. This required the construction of thirteen piers and two abutments. The two abutments and nine piers were constructed by sheet pile cofferdams and the four channel piers by the open dredging caisson method.

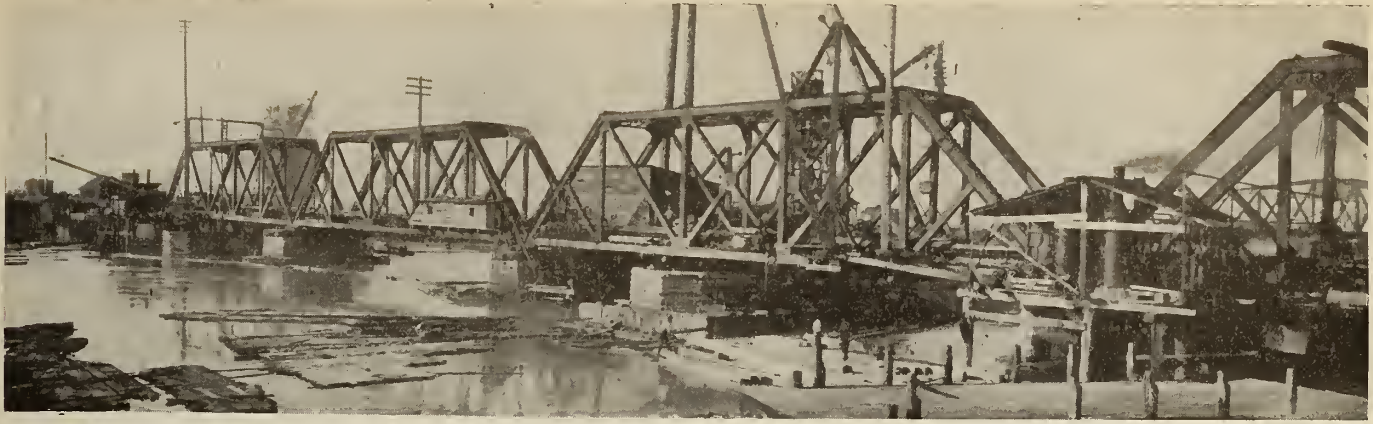
Preparatory to the construction of the piers, inasmuch as traffic had to be maintained, a short diversion trestle was built from the east side out to the end of the old swing span. This gave access to the east abutment and five piers. Later a continuation of the diversion trestle built 155 ft. downstream form the old bridge, allowed the construction of the remaining piers in the deeper part of the river. Owing to the large amount of river traffic, a temporary drawspan had to be erected in the downstream trestle.

Beginning on the west bank, piers were numbered one to thirteen on the extreme east bank of the river. Piers Nos. 2, 3, 4 and 5 were the most difficult to build. At the site of these piers there were respectively 45 ft., 65 ft., 65 ft. and 35 ft. of water at extreme low tide, with a 4 ft. tide and a 4-mile current to contend with.

The open dredging caissons for piers Nos. 2, 3 and 4 were of the same general type and were 35 ft. x 75 ft. outside dimensions with two 17 ft. x 20 ft. dredging wells. The solid timber crib was built up to 65 ft. above the cutting edge and the inner cofferdam carried up above high water level, and afterwards the top fifteen courses were taken off. Pier No. 4, typical of the three large dredging piers, was carried 36.7 ft. below the river bottom, 93.7 ft. below average high water. The total height of the pier was 105 ft. 11¼ in. These caissons were built up of 3-ply of 3-in. planks, the two outside layers being placed diagonally and the inner layer vertically. Each layer was spiked to the one adjacent and all were securely bolted to the heavy framework within. The outer walls of the caisson were shod at the bottom with steel cutting edges for protection in sinking through the bed of the river. The caissons were built up to a height of 12 ft. on shore and caulked. They weighed approximately 250 tons before launching and had a draft of 8 ft. when towed in position ready to commence building up and sinking.

Between the walls of the dredging wells and the outsides of the caissons, concrete was carried up to a height of about 20 ft. and from that point was filled with mud to get sufficient weight for sinking.

The caisson for pier No. 5 was quite different from caissons No. 2, 3 and 4, in that it was of reinforced concrete type rather than timber. The walls were 6 ft. thick including the timber crib work which acted as forms for the walls. The pier was octagonal 37 ft. x 60 ft. over all with corners cut off 45 deg.—11 ft. off the end and side. This left an area inside of approximately 25 ft. x 40 ft. which was divided lengthwise by a 4 ft. wall extending from about 2 ft. above the outside cutting edge to the top of the caisson. This division made two large dredging wells 20 ft. x 25 ft. in either end. This caisson was very heavy and sinking progressed very satisfactorily. When the caisson had reached an elevation of 14 ft., or 40 ft. below the old river bottom, a concrete seal 18 ft. thick was deposited through a tremie. From the top of this seal a four-foot wall was built dividing the two dredging wells in either end into two equal parts. This wall was carried to elevation 67.79 ft. or about 15 ft. below low



C. P. R. Pitt River Bridge. Sinking Caissons.

tide. The water was then pumped out and a temporary timber deck was put in at this point and a heavily reinforced concrete slab constructed, and on this the main shaft was built. The finished shaft of the pier being 30 ft. x 50 ft. over-all dimensions, four large cores were left in the four quadrants symmetrically with the larger cores in the body of the pier below, the idea being to diminish the dead load going directly on the slab and to effect a saving in the quantity of concrete.

The anchoring of the dredging caissons Nos. 2, 3, and 4 was a rather difficult proposition on account of the depth of water and a current to contend with both ways, as the tide moved against the current of the river and with the current of the river at about the same velocity. This anchorage was composed of eight sets of 1¼-in. galvanized cables, two on each corner, one set about 30 ft. above the cutting edge and the other 20 ft. above this. Upstream the cables were anchored 400 ft. to three Chinese anchors. These Chinese anchors, or cribs, were located so as to provide anchorage for all three caissons. Downstream the tackle was fastened to dolphins driven about 300 ft. below the old bridge. The handling of this tackle during the building up and sinking of the cribs required a great deal of skilful diver work as the deep water and the current made it very difficult for a diver to work rapidly and with safety.

In the case of pier No. 5, the water not being so deep and it being necessary to protect the caisson from river traffic, a pile fender was constructed entirely around the pier, very thoroughly braced and tied together after the caisson was floated in. This fender provided an excellent platform to work from and facilitated the dredging a great deal inasmuch as it served as a guide in sinking.

The location of pier No. 5 came directly upon the site of pier No. 7 of the old bridge and on this account about three hundred old piles had to be pulled before the caisson could be put in position on the river bottom. This was an extremely difficult job, as the majority of them extended only a foot or so above the river bottom and the tackle had to be put on the same by a diver.

East and west abutments and piers Nos. 1, 6, 7, 8, 9, 10, 11, 12 and 13, were all built by sheet pile cofferdam method. In some cases T. & G. sheeting was used; in others squared timber with splines was used. As the cofferdams were all located in that portion of the old bridge which was pile trestle, there was a large accumulation of sunken logs, branches and roots which had to be contended with in driving the sheeting for the cofferdams, and also in the excavation of the material before and after driving the round piles on which the pier was built.

All piers with the exception of No. 6 were practically the same size and in general the cofferdams for same were 22 ft. 6 in. x 47 ft. Pier No. 6, this being the east draw rest, was 22 ft. 6 in. x 56 ft. The usual method of building cofferdams was used and with the site of the pier cleared, inside and outside rangers sunk and sheeting driven. After this the excavation in some cases was made by dredging or with hydraulic excavators. The piles were driven with both steam hammers and drop hammers. The driving in all cases proved difficult on account of compact sand being encountered. In most cases a 4 ft. seal of concrete was placed by tremie and the cofferdam unwatered. On this seal the footing courses were placed and the shaft of the pier built, all in the dry.

In the case of pier No. 6, a large number of piles had to be pulled here as it coincided with the site of

Caisson No. 5 on the ways.

Caisson No. 5 built up 50 ft.

old pier No. 9. After the site had been thoroughly cleaned, however, the remainder of the work was practically the same as with the other cofferdams.

Owing to the two distinct methods of construction employed and the fact that the operations were carried on simultaneously, a large amount of plant was required. On the east side, one mixer plant, centrally located, mixed all the concrete for piers No. 6 to the east abutment, inclusive. Concrete was handled by Lakewood bottom dump buckets mounted on cars and operated along the old bridge by an endless cable haulage. For concreting piers Nos. 2, 3, 4 and 5, a floating mixer plant equipped with a derrick, sand and gravel hoppers, cement house, mixer, and 60 ft. elevator tower equipped with an Insley hoist and hopper, was used. Both mixers were the 1-yd. Ransome type. Two steam plants were installed, one on either end of the bridge. On the east side where the number of cofferdams required a large amount of pumping, a 300 h.p. steam plant was installed and on the west side approximately 200 h.p. for handling the pumping at that end. All told, there were 5 centrifugal pumps and 4 sinking pumps. Seven stiff leg derricks and 4 combined stiff leg and guy derricks were used handled by two 3-drum engine and nine 2-drum hoisting engines, together with swinging engines and Hayward two-in-one machines. In addition to the above, two diving outfits were used; two Monarch steam hammers; one Vulcan steam hammer; two drop hammers; two orange peel buckets and four clam shell buckets, and a large number of push cars, side dump dirt buckets, and concrete buckets.

Some of the quantities involved in the contract are as follows:—21,000 yards of concrete; 3,750,000 feet of timber; 40,000 yards excavation; 43,000 lin. ft. of foundation piles; 30,000 lin. ft. of round piling for temporary work.

Work was started in December, 1912, and completed in March, 1914, by The Foundation Company, Limited, Montreal and Vancouver, under the direction of Mr. H. Rindal, Division Engineer for the Canadian Pacific Railway, Vancouver.

Lock Gate Lifter for Trent Canal

THE accompanying illustrations show the steel Pontoon Lock Gate Lifter which was recently built for the Department of Railways and Canals for service on the Trent Canal by Messrs. M. Beatty & Sons, Limited, of Welland. It was designed and built to lift and place into position the lock gates, and its capacity of 50 tons and clearance of 37 feet above the deck will enable it to stop any of the mitred gates throughout the entire length of the Trent Canal. The general design comprises a structural steel collapsible derrick mounted on a steel pontoon, with separate steam engines for each operation.

The pontoon supporting the derrick is made of steel plating with extra strong steel frame work, there being two longitudinal and three transverse trusses, so as to provide for the severe loads it will have to bear. The hull is constructed with rounded bilges and each end has a rake of 45 degrees. The length is 55 feet, beam 27½ feet, and depth 9 feet.

The derrick is built of structural steel in two units. When in working position, the derrick is erect as shown in Fig. 1. In transporting the lifter from one lock to another, the upper part of derrick is lowered where necessary as in Fig. 2. This allows of its passage under overhead bridges along the canal. The operation of raising and lowering the derrick is performed by a 6 by 6 double cylinder engine mounted on one of the back legs. Two swivel hook padlocks are suspended, one from each overhanging top of the front legs of the derrick, each carrying 8 parts of ⅞-inch steel cable.

The main engine has 9 by 9 double cylinders, double drums and is link reverse. The operating levers are brought to one position for the convenience of the engineer.

The pontoon is kept on an even keel by two moveable ballast cars under deck. Each car is moved by a steel screw operated by independent 6 by 6 reversing engine. These engines are controlled by pendulum governors, automatically shifting the ballast to the proper position to put the pontoon on an even keel, whether it is under load or light, with the derrick upright or folded. In addition to the automatic control, the ballast car engines can be operated from the engine room above deck. Dial indicators are provided to show the position of the ballast cars at all times.

The machine has stepped to date the gates for Locks No. 1, 2, 3, 4, 5 and 6 of the Ontario-Rice Lake Division of the Trent Canal and in operation has met all expectations. The total time for stepping each leaf from picking up in water to releasing in gate recess varied from twenty to forty minutes, according

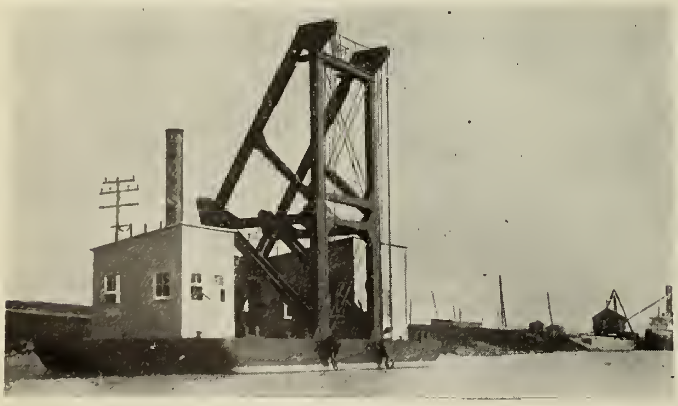


Fig. 1.—Gate lifter just after completion. Top of derrick raised.

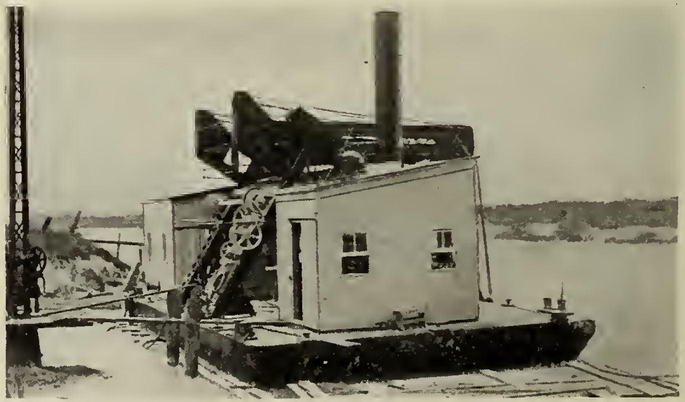


Fig. 2.—Gate lifter with top of derrick lowered for passing under overhead bridges.

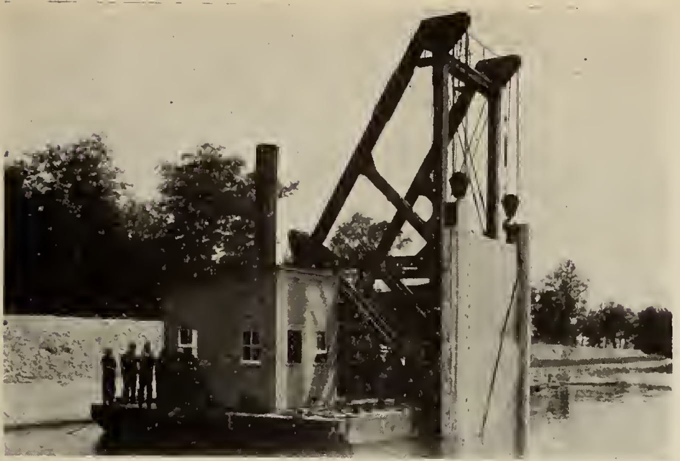


Fig. 3.—Gate leaf at lock No. 4 being raised by the steel pontoon gate lifter.

as an upper or lower gate leaf was handled respectively. At Lock No. 3 the lower gates are 37 feet high over timbers and these represent the heaviest gates the Lifter is designed to handle.

Rebuilding a Bridge Five Hundred Years Old

THE recent rebuilding of the Notre Dame Bridge in Paris is a notable circumstance in that it brings up to the twentieth century an engineering structure that was first put in service more than 500 years ago, and has since been rebuilt only three times, although in constant use. The present work, which is described by the Engineering Record, is an example of progressive American methods and materials adopted in conservative European practice. It involved the removal of three short-span masonry arches in the centre of the channel and the building in their place of a single plate-girder arch span erected on falsework trusses, the reinforcement of two pier shafts and their footings to resist the unbalanced thrust after the removal of the short spans and after the construction of the long span, and the widening of the old arch spans at the ends of the bridge. Bridge traffic and navigation were maintained throughout the construction. The old foundations were retained and enlarged and the serious obstructions offered by the centre piers will be entirely removed, thus greatly improving navigation.

The Notre Dame Bridge across the Seine is a historic structure first built about the year 1400. It was destroyed by a flood in 1499, and was immediately replaced by a structure which endured until 1852, when a new superstructure was built on the old foundations. The piers were not quite parallel to the axis of the river, and constituted a serious obstruction to navigation and caused numerous accidents. The bridge had five cut-stone arches of about 57, 61 and 62-ft. spans and a width of 71 ft. over all.

Alternative plans of reconstruction were considered, one of them involving a new centre span of 284 ft. and the other a new span of 197 ft., retaining the two end arches. As the respective estimates of cost for these plans were about $252,000 and $157,000, and as the vertical clearance was inadequate for a satisfactory rise for the long-span arch, the second plan was adopted, and is now in an advanced stage of execution.

The new span has eight riveted plate-girder arch ribs, spaced about 8 ft. apart on centres, except the outer ribs, which are about 13 ft. from the next ones. The depth of the ribs varies from about 2.6 ft. at the crown to 3.9 ft. at the skewbacks, and the centre line is a segment of a circle of 256 ft. radius, which gives a rise of about 20 ft. The ribs are connected by transverse lattice girders in radial planes. These girders have the same depth as the arch ribs at the point of intersection, and are spaced about 10 ft. apart. Vertical posts, also spaced about 10 ft., carry longitudinal and transverse girders supporting the 4 x 5-ft. buckle-plates. Wood block pavement is used except under the electric car tracks, where the concrete floor has an invert-shape cross-section supported on concave steel plates, affording clearance for the electric conduits. The outside girders are masked by cast-iron molded fascia bolted to them and joined at the crown to molded cast-iron cornice pieces.

The ends of the arch ribs are provided with cast-steel shoes in radial planes, and corresponding cast-steel pedestals are anchored to the masonry. Both shoes and pedestals are recessed to receive three full-length horizontal transverse keys with a rectangular cross-section, convex on the side toward the arch ribs, in which they have concave bearings. The keys are adjustable by shims on the skewback sides. The centre keys were first inserted, and the ribs erected with them acted as two-hinge arches under dead load only. After the erection was completed and all of the dead load imposed, the other two keys, above and below the centre keys, were inserted and adjusted to positive bearings, thus transforming the ribs to fixed-end arches under live load.

Reinforcing Piers and Removing Arches

Piers 1 and 4, carrying the river ends of the end spans, were originally proportioned for balanced loads from the nearly equal adjacent spans they supported. When the balance was disturbed, first, by the removal of the river spans and, afterward, by erecting the long new steel span, their sections became inadequate for the unbalanced stresses developed. They were therefore reinforced by extensions 10 ft. wide on both sides and by increasing the width and height of their shafts. The piers were inclosed by a cofferdam of Carnegie steel sheet piles 36 ft. wide. The interior of the cofferdam was excavated to the bottom of the old stone footing and was filled nearly up to low-water level, with concrete thoroughly anchored to the old masonry.

The three centre arches between these reinforced piers were wedged on falsework centres seated on timbers transverse to the axis of the bridge. They were supported on inclined posts seated on the old pier footings below water level and had their over-hanging tops tied together by longitudinal horizontal rails on both sides of the bridge. This arrangement left nearly all of the space between the piers at water level unobstructed for navigation and permitted the removal of the old arches and piers down to the skewbacks. Subsequently the two centre piers were removed, after having served for the support of the falsework for the erection of the new span.

The faces of the reinforced piers were racked off above the new footings and new stone-faced concrete was built over and around them, forming shafts reaching to roadway level between the new span and the old end spans. New cutwaters were built on the ends of the reinforced piers and both faces of the end spans were extended by new arch rings built out to give this portion of the bridge the same width as that of the new span.

Cantilever brackets were built on one side of the bridge to carry the sidewalk temporarily, the vehicular and car traffic was confined to a narrow adjacent strip of the old structure, and the remainder of the three old arch spans was removed in one longitudinal strip having a width greater than one-half of the original width of the bridge. Afterward six wooden falsework trusses were set on the old piers in the panels between the new arch ribs, and the latter were erected on them by an overhead gantry traveller. Some of the vertical posts of the framework trusses extended below the bottom flanges of the arch rib to carry a working platform below and parallel to the latter.

After the completion of the longitudinal section of the new arch, traffic was transferred to it, the remainder of the three old arches removed, and the balance of the new span built. The two old centre piers are now being removed. The total cost of the reconstruction of the bridge is about $273,000.

Glass-Faced Bricks

GLASS-faced bricks with concrete backings have appeared on the market. They are said to be equal to any form of tile or glazed brick as a lining for tunnels, swimming pools or bath-rooms; as well as for the inside walls of garages, engine houses, prisons, meat-markets and other structures where perfect cleanliness is as desirable as it is difficult. They are heat and cold resisting, and are declared to be everlasting, requiring no paint or other treatment to preserve their appearance. For shops and factories the concrete-backed glass brick would seem almost an ideal material. The construction of the brick is as follows: To a glass facing ¼-inch thick at its thinnest part is attached a well proportioned concrete back. The concrete backing is attached to the glass front by three separate means, each entirely sufficient to secure the union of the two materials. First, the cement on the concrete adheres to the glass; second, both ends of the glass face are returned by greater than a right angle, thus imprisoning the concrete mass; third, a dove-tailed rib of glass traverses the entire length of the back of the facing, at once strengthening the glass face and also securing it to the concrete body. The glass face is 1/16 of an inch larger all around than the concrete body, thus making possible a good mortar bond, notwithstanding that the mortar between the faces of the glass may be almost entirely pressed out. The new bricks are laid in exactly the same manner as other finished bricks.

The Salvage of Road Hauling Machinery

A FEW years ago the cost of hauling over country roads, was thought to be well established for ordinary conditions, comments Engineering and Contracting, editorially. Accurate cost data collected under many varying conditions established a reasonably accurate ton-mile estimating cost of hauling with teams; accepted for earth roads as varying between 20 and 30 cents. New developments in machinery have, however, placed at the disposal of the road contractor and superintendent other methods of hauling which, under proper conditions, are more economical than team hauling. The steam and gasoline tractor with wagon train, the motor truck alone or with trailers, and the industrial railway, each have a definite field in which their use results in a saving over any other method that might be employed.

It is not our purpose to discuss these methods of hauling or their limitations. Indeed, any but a very general discussion is valueless unless applied to a particular problem. Moreover, each construction problem is a study in itself and similar conditions do not recur with any great degree of frequency. A single factor introduced in the problem may change plant requirements completely. For example, an unusually large amount of shallow earth excavation might call for so many teams that team hauling of materials would be most profitable. Or, vice versa, a large brick or concrete construction job with light grading would be handled most economically by the use of mechanical hauling equipment.

Experience has demonstrated that under most conditions the use of machinery results in lower hauling costs and a saving in time. There exists, however, one serious drawback to its more universal use. The first cost and depreciation of mechanical hauling equipment is greater than that of teams and the salvage value is proportionately less, not only in the actual cash but in readiness of market. What causes contribute to this condition and how may the condition be remedied? First cost is of small moment if the output is increased and a ready salvage market established. Depreciation is a definite factor to consider in first cost. Manifestly the problem turns on the question of plant salvage.

Probably the most serious danger that confronts the modern road contractor is that of over equipment. Plant suitable for most economical results in road building is available but it is expensive and a large amount is required. The amount of capital invested in plant that must remain idle, from the character of the work, for a portion of the year is large. Unless this plant can be disposed of at a reasonable price upon the completion of the work, profits are tied up in equipment that may be of small value on the next work undertaken, or may become obsolete.

To alleviate this condition as well as to promote sales many reliable machinery manufacturers have established service departments and will redeem used machinery. The principle of this plan is excellent. Second hand machinery is, undoubtedly, worth more to the manufacturer than to anyone else. When rebuilt it is practically as good as new and, in the case of well standardized machines, sometimes better. One manufacturer of automobiles, noted for the profitableness of his business, has a definite policy of replacement, allowing a substantial value for old machines. This practice is of great assistance to contractors and should be developed. The proper salvage of plant used in road haulage is by no means a new idea, but the importance of its consideration with reference to hauling equipment will become more apparent with the increased use of machinery for this work which will undoubtedly come in the next few years.

It is false patriotism and false economy to contribute to relief funds with one hand and pay off or unnecessarily reduce one's establishment with the other. Our duty is not so much to provide for anticipated distress, as to take steps to prevent it by maintaining normal conditions to the utmost of our resources.

A clean, sharp, thoroughly dried silica sand or crushed quartz should be used for sandblasting. For use with a ¼-in. nozzle the sand should be screened through a No. 8 screen, and through a No. 12 when a ⅛-in. nozzle is used.

Pile drivers of the Toronto Harbor Commissioners' plant constructing retaining wall on the North Slip.

Progress of Toronto's Twenty-Five Million Dollar Harbor Development

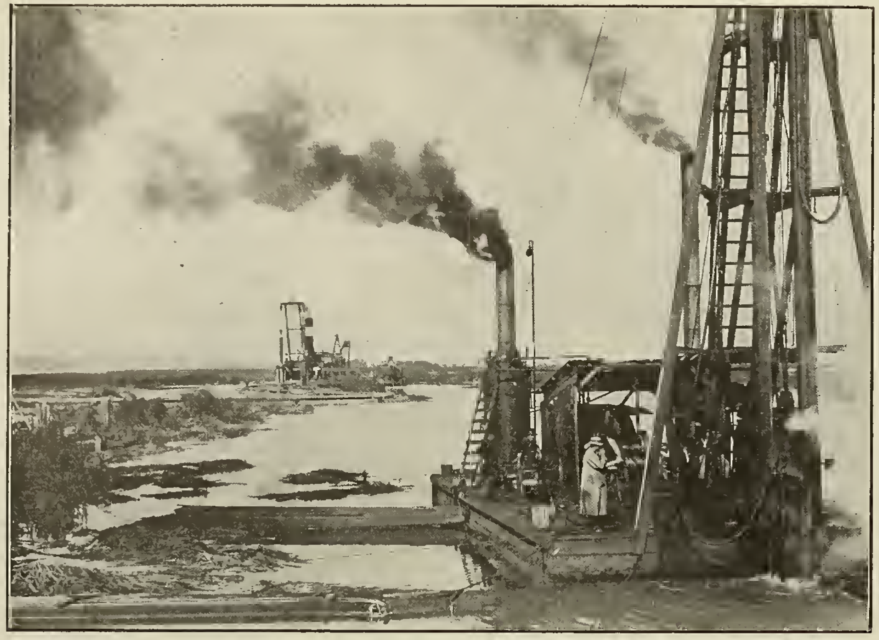
OF the many important engineering enterprises with which Canada is associated, one of the most important, from the viewpoints of both magnitude and financial outlay, is the harbor development work now under way at Toronto. The Contract Record of November 20-27, 1912, contained a comprehensive description of the scheme. In this issue further details, together with particulars concerning the actual work, are given in the form of a progress report. Operations were commenced early in the present year, and the extent of the scheme will be realized when it is stated that eight to ten years will be required to complete the undertaking and that the total expenditure will be approximately $25,000,000. The project is easily the largest of its kind on the American continent.

An important portion of the development work is undertaken by the Dominion Government and this work is at present under contract. This includes the construction of the western breakwater, the ship channel and turning basin in the industrial section, the retaining wall and the northern slip. Reclamation work for the industrial district was started last spring by the contractors whose dredges have already performed extensive filling operations. Piling has also been proceeding with marked rapidity during the summer.

For the purpose of reference it will be necessary to state that the work is divided into three sections comprising the eastern, to the east of the Eastern channel, the central, lying between the two channels, and the western section, to the west of the Western channel.

In the eastern section the development planned covers three phases—commercial and dock development, industrial development and park treatment on the lake front. A breakwater 4¼ miles long, extending from the Humber to the western entrance of the Western channel, will be constructed at an average distance at some points out in the lake of 700 feet from the present shore line. About four miles of retention piling and dock work, including ship channel, turning basin and marginal way on the bay face and northern slip, constitutes part of the work on the eastern section. On the latter section a sea wall and

Toronto Harbor Commissioners' hydraulic dredge deepening the harbor and adding land to the Island.



Commencing the construction of the big ship channel.

Hydraulic dredge No. 3 in action.

Stock of piles for harbor improvement work.

Preparing sheet piling for the North Slip retaining walls.

Toronto's Great Harbor Development Scheme

composite pile protection work, 19,000 ft. long, will be erected. Similar work on the western section will be 20,000 ft. long, and a retaining wall 6,880 ft. long, from Sunnyside to the Humber and an exhibition dock, 300 ft. in length, are also included in the scheme. In the western section there will be one 400-ft. concrete arch pedestrian bridge connecting the mainland with the exhibition dock. This bridge will be 16 ft. wide and will have about 70-ft. arch spans.

Provision for trolley, vehicular and pedestrian traffic across the eastern and western channels will take the form of steel bridges of the Bascule type, 70 ft. wide. The type of bridge for the crossing of the ship channel will also be 70 ft. wide, and will provide for the steam railway in addition to other modes of traffic. The original channel of the Don has been preserved, and what is known as Keating's Cut has been developed from the Don to the Humber. It is proposed to erect a bridge with span of 120 ft. across the northern slip at the foot of Cherry street. This bridge will be the Bascule lift type, about 60 ft. in width.

In the eastern section, on the boulevard drive, provision will be made for seven vehicular bridges with a 40-ft. span and 56 ft. wide, two similar bridges each with 100-ft. span and a width of 56 ft. For crossing lagoons several foot bridges of arch construction and approximately 50-ft. span, will be erected.

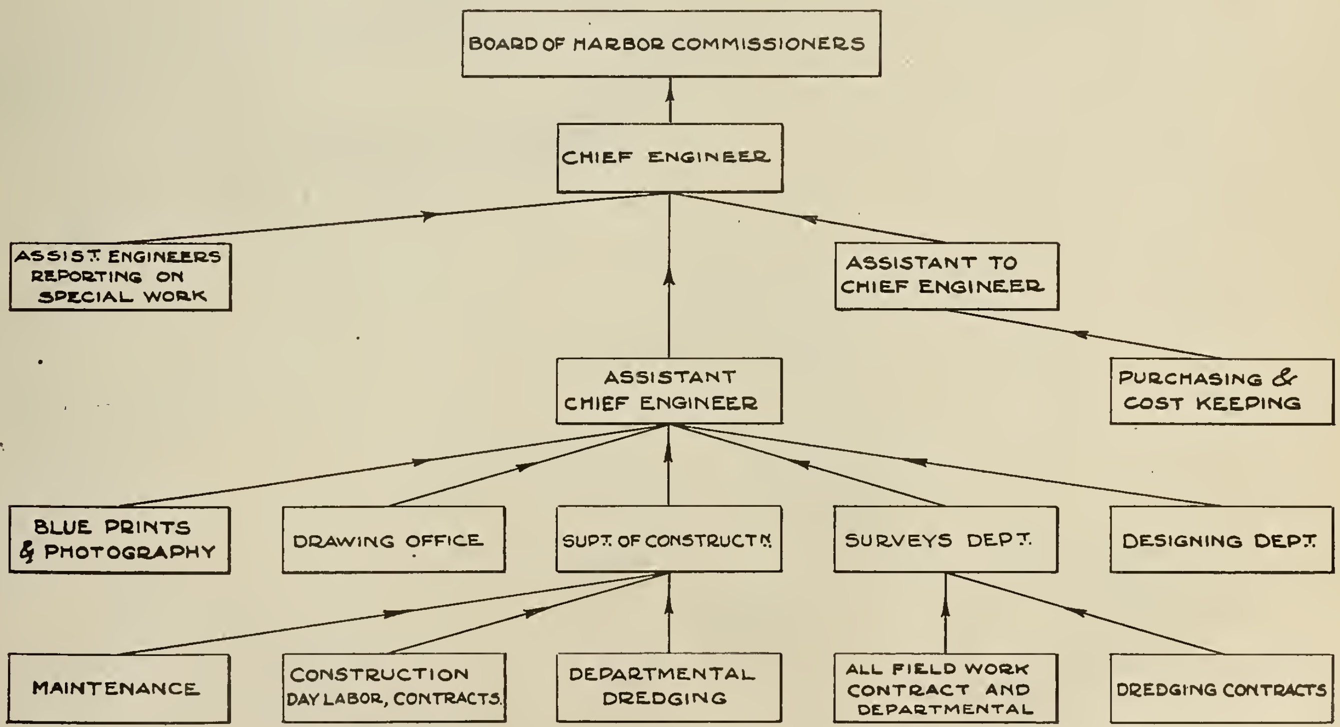
Over the central section a number of 50-ft. bridges of the arch type, and 10 ft. wide, will be provided. These will provide for street railway, vehicular and pedestrian traffic.

The Ship Channel

A ship channel will be constructed for the purpose of extending the inner harbor into the new industrial district. This channel will be 6,800 feet long, 400 feet wide and 24 feet deep with provision for future deepening to the extent of 30 feet. The channel will terminate in a turning basin 1,100 feet square and the sides of both the channel and turning basin will be so constructed as to form three miles of dockage accommodation. The sea wall, breakwater and filling work is expected to take about five years to complete. The industrial area, when completed, will contain 644 acres of land for factory sites, 235 acres of streets and railroad reservations, and 138 acres of waterways. The central or bay phase of the district will be developed for dock purposes as the district grows and will ultimately add an additional 2½ miles to the dock frontage of the bay.

The area north of the ship channel will be reserved for the location of light manufacturing plants. The

-THE-
-TORONTO-HARBOR-COMMISSIONERS-
GRAPHIC DIAGRAM SHEWING
ENGINEERING DEPARTMENT ORGANIZATION


BOARD OF HARBOR COMMISSIONERS
CHIEF ENGINEER
ASSIST.T ENGINEERS REPORTING ON SPECIAL WORK
ASSISTANT TO CHIEF ENGINEER
ASSISTANT CHIEF ENGINEER
PURCHASING & COST KEEPING
BLUE PRINTS & PHOTOGRAPHY
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SUPT. OF CONSTRUCT.N
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DREDGING CONTRACTS
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area to the east will accommodate heavier plants which do not require direct water service, and the area south of the channel will be utilized for manufacturing plants of the heavier type, requiring a frontage direct on navigable water.

Constructional Features

The amount of sheet piling required will total about 19,000,000 feet. British Columbia fir is used throughout for this work, and for round bearing piles, of which about two million lineal feet will be utilized, timber of various kinds suitable for such work is adopted. In the construction of the ship channel forty-ft. sheet bearing piles will be driven. The superstructure will be composed of concrete blocks to above water level, with massed concrete on top to an elevation of six feet above datum, which latter is established at 245 feet above mean sea level at New York.

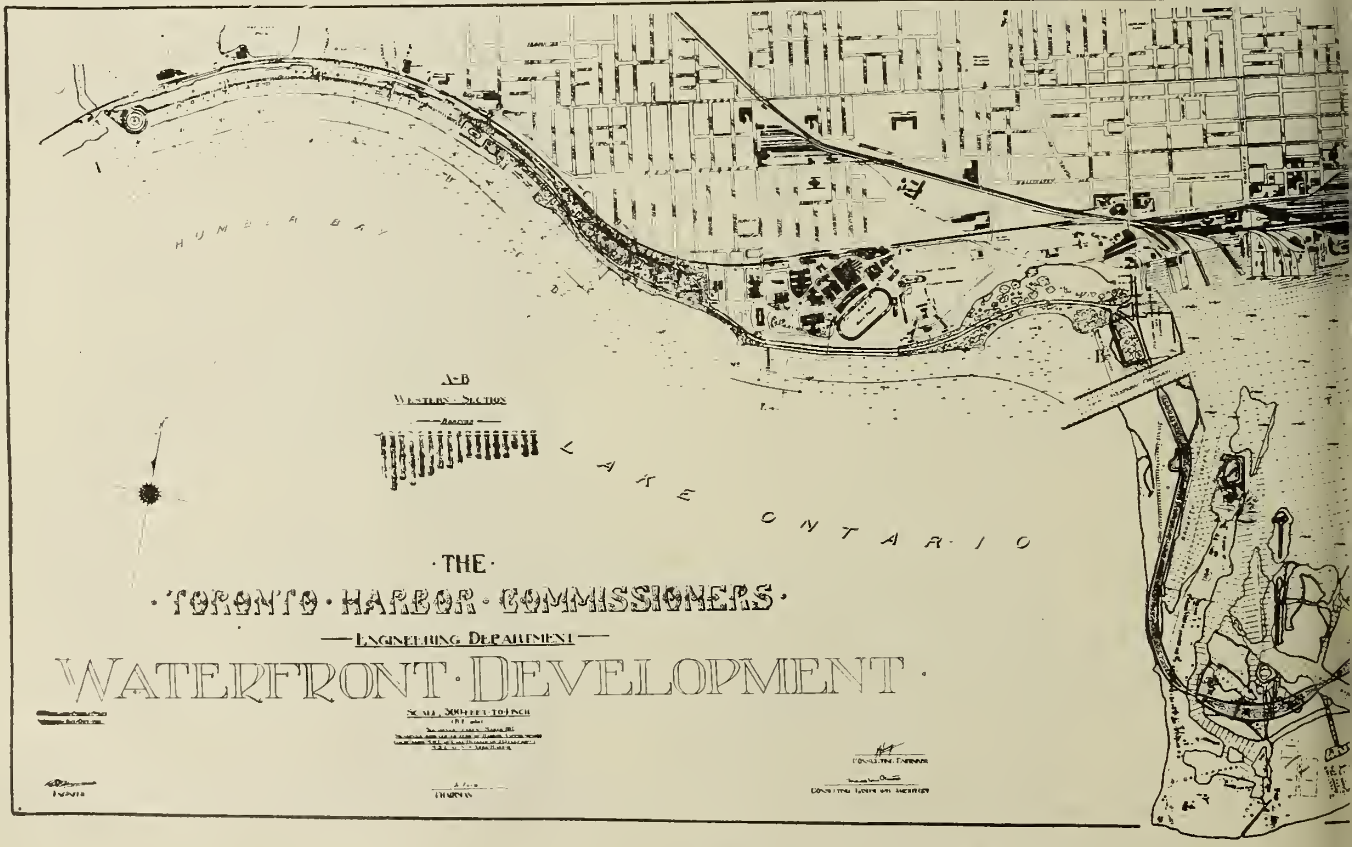
The construction of the cribs will be an important part of the work, due partly to the engineering difficulties involved. They will be standard cribs with stone fill and concrete tops, the crib work extending for about 4¼ miles. These cribs will be sunk in 100-ft. sections, each section being about sixteen feet wide and fifteen feet deep. About 40,000 cu. yds. of concrete will be placed in the western breakwater, the ship channel and turning basin absorbing about 42,000. In the construction of the sea wall about 33,000 feet of concrete will be used and the balance will be distributed more or less between the marginal way and the northern slip. The general contractors for this work undertaken by the Dominion Government are the Canadian Stewart Company, Limited, Toronto, the contract price amounting to approximately $5,400,000. In laying all concrete in water the block system has been established throughout. This consists of moulded blocks set in position on a superstructure.

The reclamation work at Ashbridge Bay is being carried out by the Harbor Commission. This will provide 600 to 700 acres of reclaimed space for the provision of factory sites. Plans are in preparation by the Harbor Commission engineers for a section of the buildings to be erected upon the marginal way. These buildings will be of reinforced concrete construction and will be leased for industrial purposes. When reclamation work is completed almost 650 acres will be available for factory sites. In the matter of transportation facilities this industrial district will be served by three transcontinental railways. The contract for this reclamation work, which is also being carried through by the Canadian Stewart Company, amounts to about $6,000,000.

Waterfront Development

The development of the water front of the inner harbor will be of outstanding importance. This section of the work will be developed as necessity demands. The plans provide for a new set of docks to replace the present piers which are becoming inadequate for the city's water-going commerce. This part of the scheme will involve considerable land filling, besides the construction of a new thoroughfare along the harbor. Piling has been completed in this section. At present the contractors have under construction two large dredges, each of which will have a daily average capacity of about 16,000 cu. yds. The other plant in operation consists mainly of standard pile drivers, steam hammers, cut-off saws, etc., suitable to the character of the work in hand.

The western section will be developed solely for



General plan of the extensive development now being carried out park and recreation purposes. The breakwater will not only protect the shore from storms but will also provide a sheltered waterway, 500 feet wide on the average, for small craft. In this section it is anticipated that about 190 acres of new land will be made. The scheme has been worked out under the general direction of the Toronto Harbor Commission.

The engineering work is in charge of Mr. E. L. Cousins, Chief Engineer, Toronto Harbor Commission. Mr. J. R. Wainwright is assistant chief engineer, and Mr. D. Molitor, designing engineer.

The war has made little difference to the big constructive works of the Government. Operations have been continued without cessation on the Welland Canal, the Hudson Bay Railway, the work at Port Nelson and the Halifax harbor scheme. Provided money conditions remain reasonably easy, this work will be prosecuted steadily throughout the war. Nothing new will be undertaken, however, and the programme of public works such as, in the usual course, would be proposed for the approval of Parliament next session, will be cut in half. Only work which has already been commenced or is absolutely necessary will be carried on. In this way the Government hopes to be able to give employment to many while at the same time practising that economy which the present situation demands. The Georgian Bay Canal Investigation Commission, it is understood, has practically ceased work. There is no doubt that this great project will be held in abeyance by the war. The Commission will continue in existence but its work will experience a temporary cessation as a result of the war.

Economy of Concrete Bridges*

By Daniel B. Luten

It can easily be shown that it is no longer economical to build temporary bridges of wood or steel except for unusual locations and conditions. Assume, for example, that a 50-ft. bridge of a temporary character costs $1,000, and that the amount is borrowed at 5 per cent. interest. Assume also that the life of the bridge will be 25 years—the average life of a steel highway bridge—and that the bridge will require re-flooring at intervals of five years, and re-painting at intervals of eight years. Then, for the 25 years, the maintenance cost will be as follows:

Interest charge, 25 years at $ 50.00	$1,250.00
Re-flooring four times, at $100.00	400.00
Re-painting twice at $50.00	100.00
Maintenance for 25 years	$1,750.00

This is at the rate of $70 per year. The original loan of $1,000 still remains unpaid, but an additional loan of $1,000 must be made to replace the bridge. Hence, for the next 25 years, the maintenance will be increased by the interest on the second note, making $120 a year. For the third 25 years, the cost will reach $170 a year, with $3,000 borrowed; and at the end of a century the maintenance will be $270 a year, with $5,000 owing on notes.

If, instead, a permanent bridge has been built, all of the maintenance for the first 25 years might have been expended for interest, making a loan of $1,400 possible at the same cost per year, and this would never need to be increased. That is to say, it would

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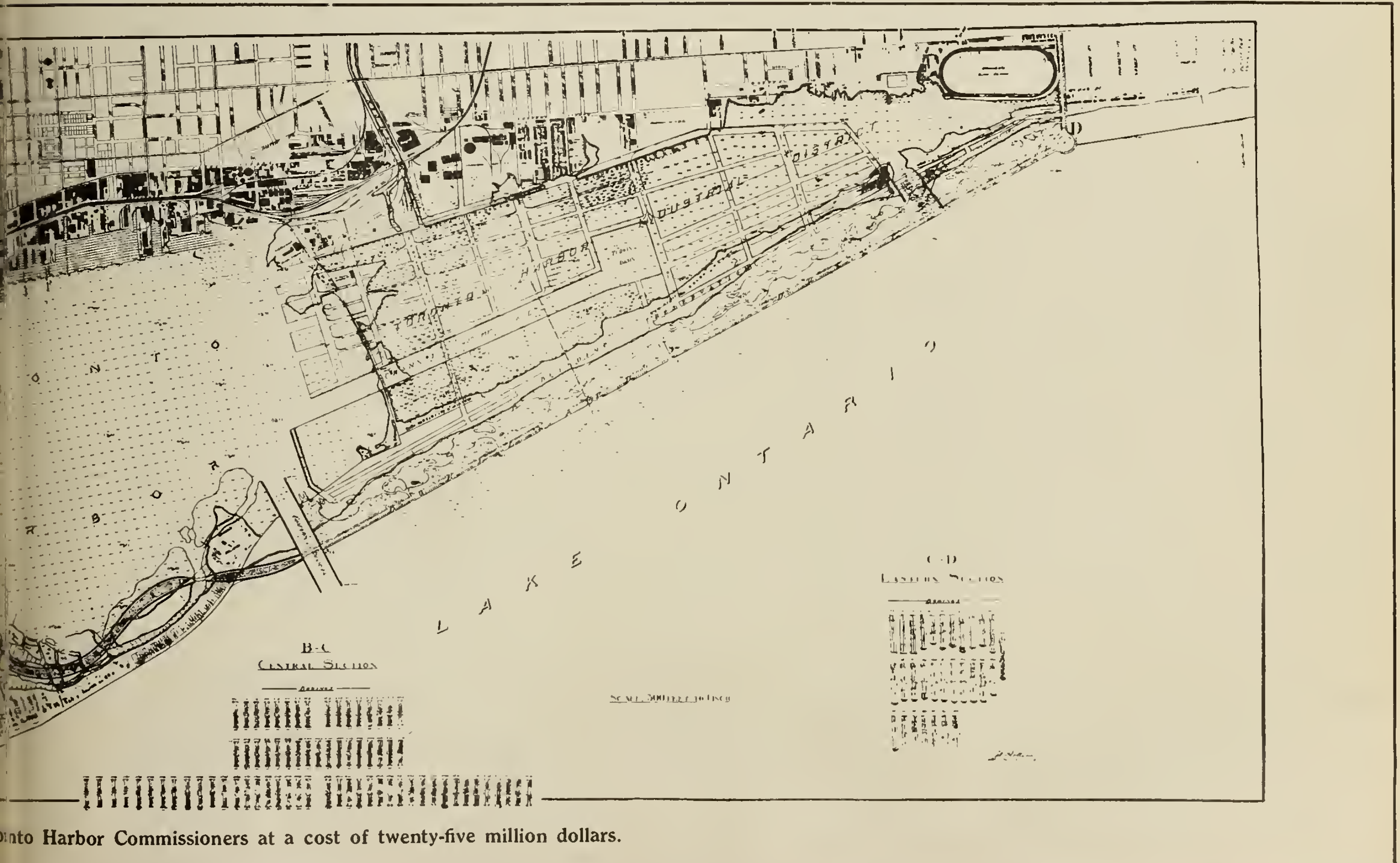
* Extract from an address before the Kansas Engineering Society.



nto Harbor Commissioners at a cost of twenty-five million dollars.

be economy, even for the first 25 years, to pay 40 per cent. more for a permanent bridge. And, if a sinking fund were established to meet the notes at the end of each 25 years, about $26 per year additional would be required, making the maintenance charge $96 per year, which is the interest charge on $1,920. So that, under the above conditions, a permanent bridge would be worth 92 per cent. more than the temporary bridge above described.

New Type of Driver for Large Concrete Piles

A FLOATING pile driver of an unusual type, and more powerful than any previously built, has been used in building the new pier of the Intercolonial Railway at Halifax, N.S., and is described in the Engineering Record. Not only will the machine handle heavily reinforced concrete piles 24 ins. square and as long as 77 ft., but it will drive them in threes, one after another, without change of position, and will handle batter piles with equal facility.

The pier and shed are entirely of reinforced concrete. The pier is 800 ft. long and 235 ft. wide and is supported on 1,800 of the 24-in. concrete piles, which range in length from 57 to 77 ft., and are each reinforced with eight steel rods from 1 to 1¼ in. in diameter, according to the length of the pile. To get the piles down to rock they have to be driven through from 3 to 14 ft. of hardpan. The design calls for some of the piles to be driven in groups of two or three, side by side, with practically no space between them, and for diagonal piles battered 15 or 16 deg., driven close against the faces of the vertical piles in order to brace them.

A wood hull 108 ft. long, 45 ft. wide and 12 ft. deep at the bow carries the pile driver. In order to support the leader carriage tracks, there are solid timber bulkheads from bow to stern, and also several transverse trusses.

Carriage

The drums and machinery for handling the piles and operating the hammer are supported on a heavy structural-steel carriage, mounted on rollers which travel on a track, and the whole is moved by means of a rack-and-pinion drive. The front of the carriage is provided with two heavy girders. The upper girder carries a trunnion bearing, which supports the weight of the leaders, while on the lower girder is a specially designed crosshead attached to the leaders in such a way that they are held firmly. Trunnion bearing and crosshead are connected to independent screw shafts driven by an engine; hence simultaneous operation of both shafts will move the leaders laterally across the carriage, while operation of either shaft alone will swivel them. In this way a transverse motion of 8 ft. as well as a fore-and-aft play of 7 ft. is provided, and canting of the leads to take care of the batter piles is also made possible.

Two forward spuds, each provided with an independent engine, hold the driver in position when in action. The spud machinery, which is located well aft, is connected to the spuds by wire ropes and is controlled by levers within reach of the engineer from his position in the travelling leader carriage. There is a third spud at the stern.

At first it was thought that piles as long as 90 ft. would be required, and the length of the leaders was fixed to accommodate such piles. The leaders are, therefore, 76 ft. long over all, standing 70 ft. above the deck.

Hammer

The steam hammer is said to be the largest double-acting steam pile-driving hammer ever made. The combined weight of hammer, follower and follower guide is approximately 28,000 lbs. The cylinder is 14 ins. in diameter and of 36-in. stroke, and the weight of the ram alone is 4,000 lbs. With a mean effective steam pressure in the cylinder of 80 lbs. per square inch the hammer is rated to develop 3,916,000 ft.-lb. per minute when the hammer is striking eighty blows per minute.

In order to take care of the reinforcing bars, which project 3 ft. above the ends of the piles, the hammer is fitted with a special cap. The leaders are equipped with a special hammer track, by means of which the hammer when hoisted can be switched in out of the way of a swinging pile. An automatic locking device is provided at the top of the leaders to support the weight of the hammer while the pile is being placed in position, and there is also an intermediate stop to hold the hammer when the driver is not in use.

Scows deliver the piles to the driver, two derricks handling them. The machine was originally intended to drive one pile an hour, but has proved able to handle twenty or twenty-five in a ten-hour working day.

The pier was built by the Nova Scotia Construction Company, Limited, of Sydney, N.S., under the direction of Mr. John Kennedy, consulting engineer, of Montreal, and Mr. A. F. Dyer, his local representative. The Bucyrus Company, of South Milwaukee, Wis., designed and built the pile-driving machinery, collaborating with Mr. W. L. Scott, chief engineer of Mussens, Limited, of Montreal, who was consulted by the contractors and who designed the hull and the derricks. The Union Iron Works, of Hoboken, N.J., designed and built the steam hammer.

The record of C. P. R. work in connection with the Rogers Pass tunnel shows on the east side—pioneer heading—4,107 feet; main heading, 1,580 feet; west side, pioneer heading, 1,127 feet; main heading, 406 feet. This is considered to be good work when the extreme difficulties are considered. The men, some 700 of them, are working virtually in the clouds. They work and eat and sleep on the same level. The work proceeds through the solid rock. Pioneer tunnels are being built to enable the main tunnel to be tackled at several points. This is a work of uncommon magnitude. The point about it is that although the war has altered many things, this work, which is to cost $10,000,000, goes steadily on toward realization. It may be described as the most important work which the C. P. R. has presently on hand. Tunnel experts all over the world are interested in the progress of the work, which is unique in many respects, especially with regard to the high altitude.

Steel passenger cars for Indian railways are said to be under consideration by some of the railway companies, owing to the increasing price of teak wood and the decreasing price of steel. At present, steel freight cars are used extensively, and the modern passenger cars have steel underframes with wood bodies. In view of the intense and continued heat, special means of insulation and ventilation would be required for steel bodies of passenger cars.

Shoulders for Concrete Roads*

WITH the almost universal tendency in concrete road construction to keep the width of the concrete as low as practicable, in order to reduce the first cost (per mile) of the improvement of a road, has come, in many cases at least, the neglect of proper consideration of the matter of shoulders. In many cases the neglect referred to has unquestionably resulted in extravagance and waste in the long run, even if it has secured economy in first cost.

While authenticated records covering reasonable periods and concerning the relative expense for the proper maintenance of road crusts and of shoulders respectively are not readily available, certain instances of such records (as published concerning Park Heights Avenue, near Baltimore, Maryland),† together with the individual experiences related by many authorities, tend to show that the shoulder maintenance costs may be no inconsiderable part of the total maintenance costs of a modern road, and that it may often be real economy to build the road crusts wider in order to reduce this annual expense for maintaining the shoulders, and thus the total maintenance cost per square yard. From the Park Heights Avenue records, above referred to, it may be seen that, although the travel over the 24-ft. wide sections was four times that over the 12-ft. and 14-ft. sections, the cost of maintenance per square yard of the road crusts of the latter was more than twice that of the crusts on the wider sections, and the cost of maintenance on the shoulders on the narrower sections was nearly three times that for the shoulders along the wider crusts. Indeed, the economy in maintenance on both the shoulders and road crusts of the wider sections indicates that, in a ten-year period from the date of construction, real economy would have been had by increasing the width of the road crusts so that nowhere would the latter have been less than 18 ft.

But the subject for consideration is not "The Economical Widths of Road Crusts," but "Shoulders for Concrete Roads," and after the above specific illustration of the importance of shoulder consideration that of the actual subject may be resumed.

The actual width of the concrete roadway to be built must be determined by the traffic conditions to be expected on the road, and if these are sufficiently heavy to warrant so doing, it will probably be economical often to make the concrete itself wide enough to permit the passing of two lines of traffic wholly on its surface and without any necessity for either of passing vehicles to travel off the concrete on to the shoulder. On the other hand, traffic and other conditions may be such as to permit the greatest economy to be had by making the concrete only wide enough for one line of traffic and allowing the occasionally passing vehicle to travel on the shoulder for the moment.

The immediate vicinity of the line of contact between the edge of the concrete and the shoulder material will be found to be the tender region of both the road crust and of the shoulder. The high rigidity of the concrete road, and consequently the greater contrast between such a road crust and other material usually available for shoulders, increase the importance of the careful consideration in the matter.

Where the concrete road crust is so narrow that vehicles are almost constantly, in avoiding others, passing from the concrete to the shoulder, serious wear of both the road crust and the shoulder will be found to take place along the region of contact referred to, and this wear is frequently accompanied by the formation of a rut in the shoulder, which holds water in wet weather and thus endangers the foundation of the road. Some of the passing traffic will undoubtedly turn out on to the shoulder further than the rest, but at the extreme outside of the shoulder the travel over it may be so light and infrequent that the natural material there is not strained beyond what might be called "its elastic limit," and there, then, is no reason, on this account at least, for its replacement at any extra cost.

It will therefore be seen that the selection of the material and methods for the construction of shoulders to a concrete road requires the use of something between the natural soil, at the outside extremes, and the concrete itself; that the choices are determined by local conditions, such as availability of different materials and methods, width of the concrete road crust, amount of traffic, etc., and that the wearing abilities or "elastic limits" of the shoulder material at any point should be outside or above the stresses to be expected at that point.

The passage of traffic from the pavement to soft adjacent material can, of course, be absolutely prevented, and the protection of the edges of the pavement be had by the installation of a raised edging or kerb, as in the cases of most streets. The necessary reinforcement of the shoulder where no raised kerb is to prevent traffic going off it. In doing this the centre thickness of the crust need not necessarily be preserved to its edges, but the thickness may be tapered down somewhat at the outsides. Or this widening (and tapering down in thickness) of the road crust may be done over a portion of what might otherwise be the shoulder, and then the reinforcement continued by the use of macadam or pit gravel or other materials as may be necessary. Again, the width of the concrete road crust being fixed, the shoulder reinforcement may be had by the construction of pitch-concrete, pitch-macadam, water-bound macadam (with or without a pitch carpet), etc., adjoining the concrete road, all as may be necessary and desirable under the local conditions. The actual determination must be left to competent parties who will give due consideration to the local conditions and the principles referred to above.

This committee therefore endorses with its approval and recommends the adoption by this body of a clause similar to that in the recent report of the Special Committee (on Bituminous Materials for Road Construction, etc.) of the American Society of Civil Engineers, and as follows: "Where cement-concrete pavements are laid the edges should be protected, and a sudden transition from the pavement to any softer shoulder material avoided by means of cement-concrete or other edgings, or such reinforcement of the shoulder material as may be necessary."

The Hudson Bay Railway which will bring Saskatoon within 738 miles of tide water, and save 1,186 miles railway haul to Montreal, is progressing rapidly. By this fall, the line will be graded to a point 110 miles from Hudson Bay, while it is expected that by then rails will be laid to the first crossing of the Nelson River, at Manitou Falls, so that a train may be run to within 155 miles of the Bay.

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* Substance of report presented at the National Conference on Concrete Road Building (Chicago).

An Orillia Building Which Exemplifies Up-to-Date Factory Design

Staff Article

IN a new woodworking factory which is being built at Orillia for Messrs. J. R. Eaton & Sons Company, Limited, there are noteworthy features of design and construction. The general details of design are conveyed in the elevations reproduced on the opposite page, while the construction is shown clearly in the other illustrations. Generally, this plant may be said to embrace the most up-to-date principles in the design of buildings of this type and the factory upon completion in November will be one of the finest of its kind in Ontario.

The construction of the new Eaton factory was commenced last May. The site of the plant covers an area of nearly twelve acres. The main building is 151 ft. by 304 ft., one storey high, of mill construction. The boiler and engine room, dry kilns and store rooms are connected with the main section of the plant by a covered way. The roofing is of Barrett Specification felt and gravel. The walls are of Denison interlocking tile, manufactured by the Sun Brick Company, Limited, Toronto. It will be apparent to the reader that in the design of the building particular attention was paid to lighting, adequate light being provided from all sides. The flooring throughout is concrete and all possible precautions have been taken against fire. A sprinkler system has been installed. The timbers used in the construction are British Columbia fir, the posts being pine and hemlock, dressed 2 ins. by 4 ins. on edge.

New Plant of J. R. Eaton & Sons, Orillia, Ont.

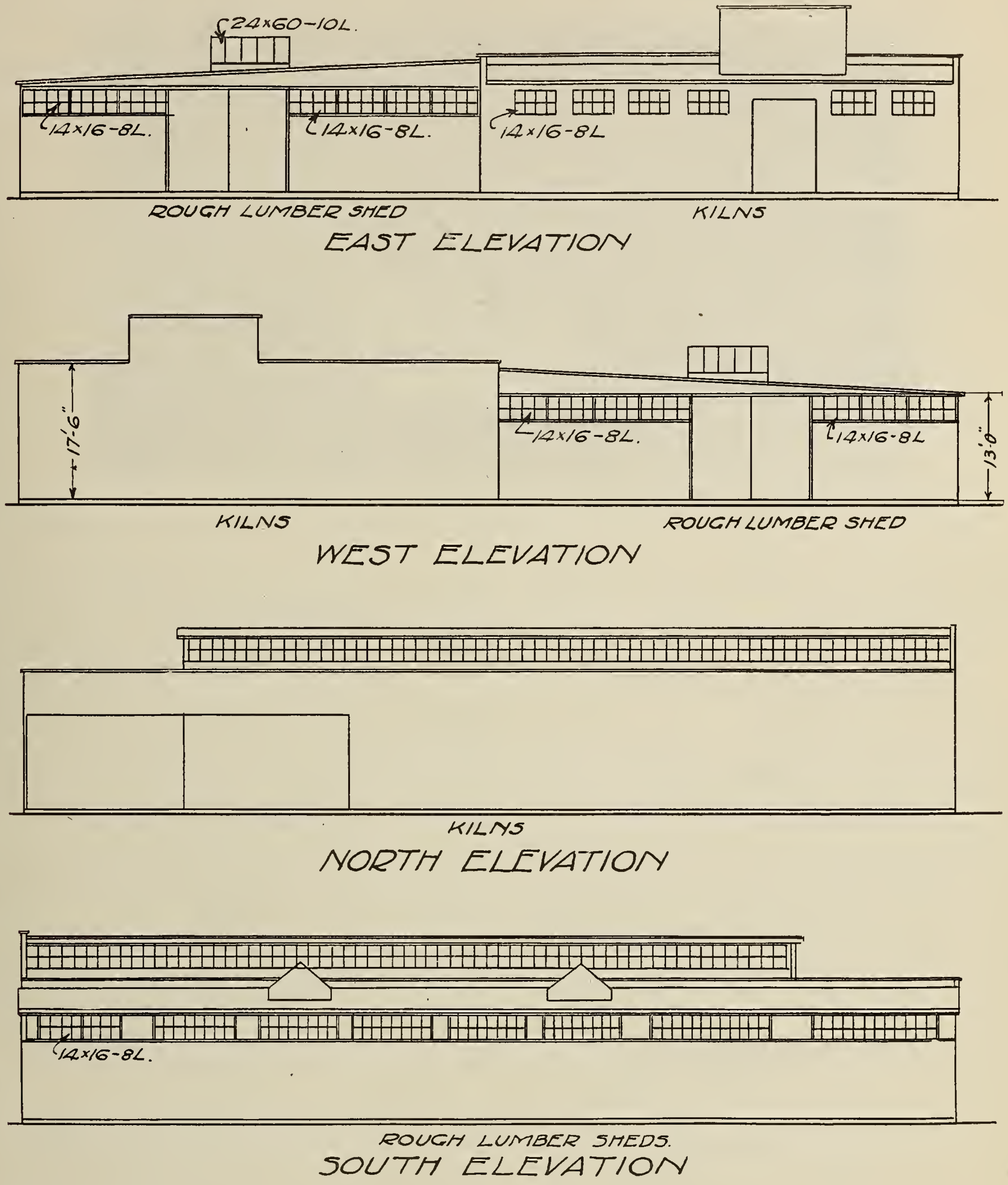
An interesting feature of the new plant is the box, or pocket, type of dry kiln installed by the Grand Rapids Veneer Works, whose contract comprised eight fireproof box kilns of the latest pattern. These kilns are built of hollow tile and cement, with a unique system of transfers and elevators operated by electric power. The lumber is run in on the transfer car and discharged into the kilns. An important advantage claimed for the box over other types of dry kilns is the division of the former into eight boxes, four of which have a capacity of five cars each, the capacity of the other four being two cars each. By this means, variations of temperature are avoided, and different varieties of lumber, either hardwood or softwood, can be dried independently. The kiln is 120 ft. by 62 ft. Adjoining the kiln is a large storage shed for drying and storing the lumber as it emerges from the kiln. This building will be kept at a uniform temperature during the cold weather. A dressed lumber and storage shed is provided for loading and shipping the finished product. In the equipment of the plant an interesting feature is an endless chain conveyor, which takes the shavings and waste direct to the furnace. One of the most important factors in connection with this system is the claim that hand firing is rendered unnecessary by its use. Power is supplied by a Wheelock engine of 225 h.p., the electrical energy being generated on the premises.

The J. R. Eaton & Sons Company are manufacturers of general mill work, including hardwood flooring, exterior and interior finish. They wil lshortly have an up-to-date plant with excellent facilities which include a mile of sidings on the G. T. R.

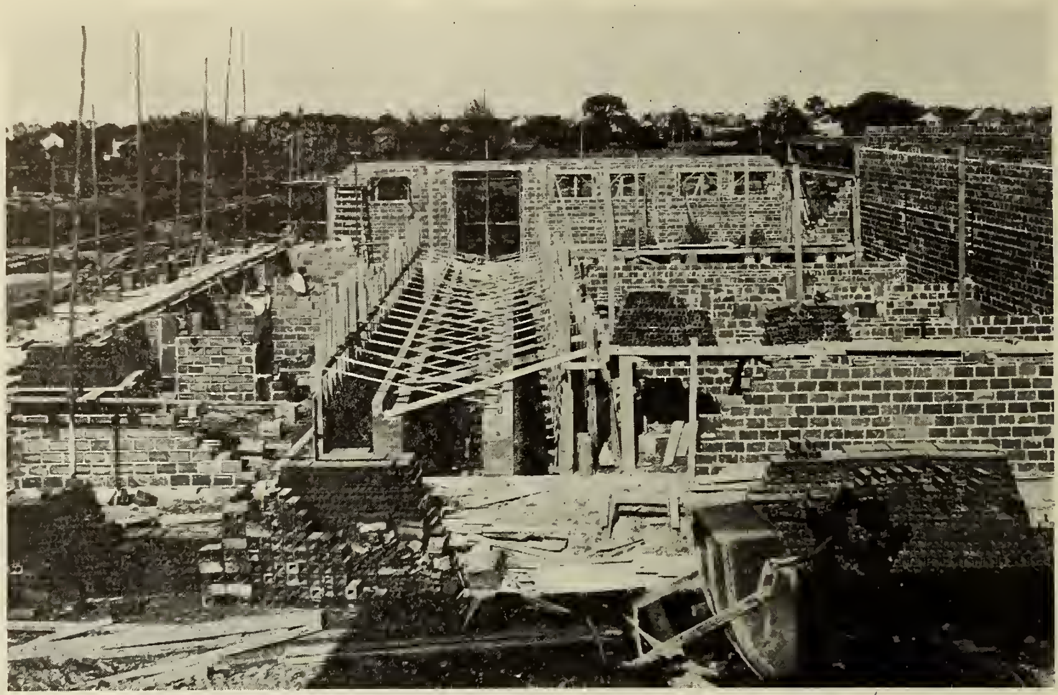
The chimney stack will be built by that well-known firm, the Alphons Custodis Chimney Construction Company, of New York, whose Canadian office is in Toronto.

Geographically, Orillia is particularly favored in regard to the development of its various industries. The town is situated on the Trent Valley Canal, and

J. R. Eaton Company's main building in course of erection.



Elevations of the new factory of Messrs. J. R. Eaton & Sons Co., Limited, Orillia, Ont. The various illustrations are suggestive of a type of construction which is coming into increasing favor in industrial plants of this type. The facilities provided in the way of efficient lighting, and of having operations conducted on one floor, are important factors.



Dry kiln under construction at the J. R. Eaton Company's plant at Orillia, Ont.

is served by three transcontinental railways. During the last decade there has been a notable increase in population.

The Concrete Superintendent*

Qualifications That are Essential to His Success

By L. C. Wason

THE very first step which a contractor must take in starting the execution of a job is selecting a general superintendent to handle the work. The type that is hired for a single job, and discharged at its completion, is not worth having. The really desirable superintendent is a development from experience, the one survival from many tried; and, when once obtained, a firm cannot afford to lose him. Some owners and engineers appreciate the value of personality so much that they have given the writer's company contracts under condition that a certain superintendent be put in charge.

Frederick W. Taylor, in his excellent paper entitled "Shop Management," specifies nine different qualifications which go to make up a well-rounded man, namely: "Brains; education; special or technical knowledge; manual dexterity or strength; tact; energy; grit; honesty; judgment or common sense; and good health." He states that there are plenty of men to be found who embody three of these qualifications. Four make a higher-priced man. A man combining five is quite hard to get; and one combining six, seven, or eight is almost impossible.

If a building superintendent is to be successful, he must combine at least seven of these qualities. He must have brains, special and technical knowledge of both direct contract and sub-contract work, tact, energy, honesty, judgment, and good health. He must have a personality which drives to activity several hundred originally unorganized men who are without special interest in the company they work for or in the result accomplished, and with such tact and judgment as to weld them into a harmonious working force, cheerful and self-respecting, with high morale, and ultimately with enthusiasm for the work in hand. He carries a care so great that he builds in full size, with permanent materials, the intricacies of design which trouble the engineer's drafting room to show clearly on paper; with an honor so fine that the company is ready to leave its reputation in his hands, to trust him with funds; and with special experience so trained that dangerous operations are carried on as a matter of routine, without worry to himself or the company, yet with a constant oversight of a thousand chances for accident or perhaps death which may occur to the men in his charge; with a forethought so great that he sees ahead and provides for the problems which are to come up perhaps months later; with a temper so good that he never loses self-control under the most provoking circumstances, and is able to take with the best of grace changes in his plans from the office, and to work in the close co-operation with the company which is so necessary to make it an effective contracting organization.

Such men have a temperament that responds quickly to criticism or praise. Praise comes sparingly, even when deserved, while criticism is freely meted out. Superintendents in the employ of the company have recalled to memory words of appreciation from an owner or an engineer long after the job has faded from the writer's memory, and he has seen a man's work improve in quality and cost purely through praise for some detail of the work which was ably handled or some difficulty which was ingeniously overcome. The company, including its superintendent, feels as much pride in the jobs it does as do the engineers who have designed these structures. The members of the executive force on any job which is sharply criticized, will try to avoid criticism by refusing the slightest responsibility beyond what they believe to be clearly their own. A company sharply criticized by an engineer is likely to do precisely the same thing, and will throw onto the engineer every bit of responsibility which it can possibly avoid. The attitude of the engineer in this respect is reflected in the execution of the work. One engineer may call attention to a mistake with a letter that is harsh and ends with a sting, which leaves the feeling of injustice and soreness in the recipient. Another, in calling attention to a similar matter, ends his letter with some expression like the following: "We appreciate your wish to make this work as satisfactory as possible, and recognize that this occurred through failure to understand my exact requirements." In response to such a letter as the first, the tendency is to do just as little as will satisfy the engineer, and take your own time about it. But, as the writer knows from personal experience, in response to the second letter, you jump to correct the trouble cheerfully, quickly, and without comment, and also sometimes do more than was asked for.

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* From a paper—"The Problems of the Contractor," read before the Boston Society of Civil Engineers.

The problem in selecting the superintendent which the contractor must consider, is whether in the particular location he will be able to handle the difficulties which arise. Perhaps the owner and engineer desire an exceptionally fine appearance in the finished mill. One superintendent is especially good at this. Perhaps finish is of no great moment, and business ability is, on account of the job being isolated so that the superintendent is left alone for some days at a time. Perhaps the local conditions may demand a great deal of tact in the handling of labor. The following illustration shows what tact is required. When the writer's company executed its first contract in Buffalo, it was for a firm which had had considerable trouble with labor, and it was anticipated that there would be a strike before the job was very far advanced. This firm had been marked by the local labor organizations as their natural prey, and these organizations were also prejudiced against outside firms coming into their territory. The carpenters there have a strong organization. During the early stages of this job, while there were but a few carpenters, the superintendent could give them considerable personal attention, and things went smoothly; but as soon as work began on the second floor, where they could not be so easily seen and the superintendent was too busy with other matters to watch them closely, unit costs began to climb day by day. The superintendent studied the situation to find the cause. By the time form work was starting on the third storey, he became convinced that the union steward of the job was to blame and was holding the men back from doing their best. The natural impulse would have been to discharge him immediately, but that would have made hard feeling with the union. The superintendent took this man aside, confided to him his troubles, and then made this man sub-foreman with entire charge of erecting forms for columns, which was the particular item that showed the highest cost. Immediately the costs came down, and on the fourth storey were the lowest on the whole job. The result was saving a thoroughly first-class workman and keeping in the good graces of the local organization.

These various questions must be weighed and settled before a start is made. Experience has shown that after a job has once started with a given organization, a change in the superintendent is the cause of much disturbance to its satisfactory completion and economy in the handling of labor. It is of the most vital importance that this question be settled rightly once for all.

The Use of Filter Wells and Filter Cribs

THERE are in use several methods of filtration by the various consumers of Ohio River water, namely, the well system, the crib system, slow sand, rapid sand and the Smith system. These systems were described by Mr. C. E. Cooke, city engineer of Wheeling, W. Va., in a paper before the Central States Water Works Association. The well and crib systems are here described from information taken from that paper.

The well system either takes its water from wells drilled in the sand and gravel bars forming the bed of the river or from sand and gravel banks along the river, and in either case, the wells secure a large percentage of ground water. The wells are usually drilled wells with the casing driven down to or into the bed rock a short distance. The bottom of the casing is drilled with holes varying in diameter from ¼-in. to ½-in. Some of the well systems have a solid piece of casing at the bottom of the wells and then a perforated pipe above this solid piece. The water is either allowed to flow by gravity from the wells to the pumping station well and is then lifted by steam pumps to the consumer, or is lifted by compressed air out of these wells into a sub-basin and is then pumped to the consumer by steam pumps. The local conditions govern the method of furnishing the water used. The casing in the wells varies in diameter, as does the size and number of the perforations used. The well system generally supplies a water that is hygienically pure, but the water is nearly always harder than the river water, and, in some cases, wells have been known to show contamination after some years of use, as well as to show a considerable decrease in the quantity derived from the wells.

The crib system is usually built of timber, brick or concrete near the bank of the river with the water flowin and through the sand and gravel with which the crib has been filled. The river water filters through the said sand and gravel to the intake pipe of a pumping station and from there is pumped to the consumer. The danger of contamination is great in the crib system and the mud and silt are drawn through and into the sand and gravel, causing the crib to become clogged and the supply greatly, if not wholly, cut off. The crib is usually entirely submerged so that it is not readily accessible and so cannot be cleaned; thus the danger of contamination is great, and after contamination is found to exist, the only remedy is to abandon the crib or to cofferdam it and remove the sand and gravel, which is necessarily an expensive process and causes the consumer to use the raw river water during the execution of the work, thus contaminating the mains and services and opening the way for typhoid fever or other water-borne disease.—Engineering and Contracting.

On the North River, New York, a new pier is to be constructed, 1,050 ft. long and 150 ft. wide, and a corresponding half-pier, giving slips 360 ft. wide, and having a depth of water of 44 ft. Preliminary work has already made considerable headway, a cofferdom having been constructed on sheet steel piles, encircling an area of 800 ft. by 300 ft., so as to allow excavation of rock on the site to proceed in the dry.

Economic Factors Involved in Road Construction in Strictly Rural Sections*

IT is fundamental that any outlay of money must be made in such a manner that it will result in a paying investment to the community. In order to obtain this not only the first cost of the improvement must be considered but the funds so invested must be protected from loss by waste and decay. The conclusions to be drawn from this are: (1) That no road should be improved without some provision for the maintenance of such road. (2) That all unprofitable work and works "de luxe" should be avoided within certain limits. (3) That all improvements not actually and positively needed should be omitted or postponed. As examples of such improvements the author may cite the adoption of costly surfacing for portions of roads where the traffic provided for will come at a later period, and all other unwise selections of surfacing either with a view to economize on the first cost or to display some luxury. (4) That the choice of some kind of pavement, the durability and ease of maintenance of which has not been ascertained in practice, be avoided as much as possible. (5) That unnecessary experiments be avoided. It is better to profit by experience obtained elsewhere and to make only those experiments which are absolutely necessary for adapting some good recognized product, process or method to local conditions.

Again, as the improvement of roads, like industrial or commercial investments, has to be a paying one, the sum invested should, in the author's opinion, be divided into three parts; one to be set aside for work which does not decay and can be easily and cheaply maintained without loss of value; one for work which decays and cannot be maintained without loss of value and for which a depreciation fund is to be provided; and a maintenance fund for annual repairs.

In the case of a macadamized road, for example, the cost of the earthwork, of the drainage and underdrainage and of the foundation should be considered as belonging to the first class; the cost of the surfacing to the second class, and to the third class the money required annually for maintenance.

Again, there should be no hesitation in spending money judiciously and when needed for earthworks, underdrainage, ditches, substantial, well designed and well constructed concrete bridges and culverts, and good and appropriate foundations.

All money so expended adds value to the country, prepares roads for the surfacing, even when the latter is to be laid later, and is remunerative. Such kind of work well planned and well made lasts a very long time and requires little money annually for maintenance. On the other hand it is a waste of money to use costly wearing coats on a substructure not well drained or a water-bound macadam on hills with a 10 per cent. slope.

Further, the author's impression is that the improvement of the roads should be begun by preparing the substructure, lowering grades or rounding up hills, drainage surface waters and under-drainage ground waters, constructing bridges, straightening unnecessarily tortuous roads, maintaining these improved substructures as earth or gravel roads as the case may be pending the next step of the improvement, and the laying of surfacing. All this can be done economically. Surfacing should be used only when and where necessary. This mode of procedure would have a great advantage which is worth being insisted upon. Laying wearing coats on new fills not sufficiently settled, or on a new soil not sufficiently trampled by traffic nor well seasoned, accounts for many failures of good surfacings and for expenses of maintenance greatly exceeding the provisions. Quick work in road making is not always to be recommended.

When the substructure of a road has been prepared and the foundation laid in advance, inconvenience is to be feared. Another occasional advantage is to divide the work. Contractors specializing in earthworks sometimes are not well acquainted with the laying of wearing coats, or have not at their disposal the skilled workmen required for such work, and the reverse is the case for surfacing contractors.

Width and Cross Section

The author does not advocate the spending at present of all available money in preparing substructures of rural roads. Provincial roads are badly needed and for these the work must be pushed quickly; but stress must be laid on the advisability in many cases of preparing the substructure of roads in advance, and on the inconvenience of laying surfacing on improper and unseasoned substructures. There is no standard cross section for substructures of roads, but details should be standardized in accordance with the results furnished by experience. The width of 24 ft. between ditches is not too great, but just what is needed for two wide automobiles or two hay wagons to pass each other, or a hay wagon to pass a wide automobile; for such cases plenty of room should be provided. It would be better to widen than to narrow the roads. When a horse vehicle meets an automobile, if the horses are nervous and deep ditches run alongside the road, a traveller often feels that 24 ft. is not too wide. This width should be reduced only in roads of secondary importance or when called for by special conditions. Even for roads much less important than provincial roads this width should be adopted if an increase of traffic is foreseen in the near future. In trunk roads the width between ditches may be increased if necessary to 32 ft. or more and should never be less than 24 ft.

On embankments the platform should receive an additional width of 3 ft. and have a total width of at least 27 ft. from edge to edge, because the back of the guard-rail posts should be set at least 1 ft. from the edge of the embankment.

In cuts, generally, no ditches are needed and gutters prevail; consequently, the total width of the platform at the bottom of the cut can usually be reduced to between 26 and 28 ft. for a 24-ft. wide road.

The edges of the embankments should be bevelled or rounded when the engineer has to deal with a clay soil, in which case it is useless to try to get sharp edges.

The slopes along the embankments and cut should generally be 1½ horizontal to 1 vertical, but engineers may avail themselves of the nature of the soil if well acquainted with the natural slope of one particular soil.

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*Abstracted by Engineering and Contracting from a paper by Gabriel Henry.

In this country it is necessary to avoid cuts on account of the snow, which, in winter, fills them and renders the road impracticable.

If the road is to receive its surfacing later, it should be given a transversal crown of at least 1 in. in the foot in order to shed the rain-water into the ditches and to allow maintenance with split-log drags. If the road is to immediately receive its surfacing, shoulders at least 4 ft. wide should be provided. The slope of these shoulders towards the ditches should be at least 1½ ins. to the foot.

Such are the principal features of a cross section of the substructure.

Earthwork

For the execution of the earthwork the same rules are to be followed as in the case of railways. For shrinkage the rates of fills to cuts comprise between 1.15 and 1.30—1.15 being for heavy work and 1.30 for light skimming work.

In the author's opinion the rolling grade system with vertical curves should be adopted, because it is more economical and facilitates the drainage of the substructure. It is useless to try to get at great cost long stretches of horizontal road. The maximum ruling grade should not be more than 5 per cent. whenever possible, 6 and 7 per cent. grades being resorted to only in short patches when absolutely imposed by necessity. A waterbound macadam is maintained only at great cost in this country on grades of 7 per cent. and more, and on account of the snow filling the ditches in the spring water from melting snow, in many places, injures the roads. The same holds for earth or gravel roads. It is better to try to get 5 per cent. by turning around hills when improving a road than by cutting them too much. Minimum grades should not be less than 0.6 per cent. to ensure the longitudinal drainage of the road.

Curves having a radius less than 300 ft. should be avoided in steep grades and at the foot of such grades, and a radius less than 200 ft. should always be avoided even in flat stretch. When it is necessary to adopt a radius less than 200 ft., the road should be widened in the curve and be given a transversal slope towards the centre of about 1 in. to the foot.

The end of the beginning of a slope should not be found at a distance less than 50 ft. from a level crossing of a railway or from the end of a bridge. Sight distance in horizontal or vertical curves should be at least 300 ft., depending in each case on the conditions. Near a railroad crossing the sight distance on each side in the direction of the track should be at least 3,000 ft.

In every case, the economy of grading should not be the controlling factor. The most important considerations should always be kept in mind in determining the profile and the cross sections. The standards can be used as general guides, but good common sense and acquaintance with local conditions should have much to do with it.

The earthworks are computed as for railways, but for roads greater exactitude is needed because in this case they consist chiefly of skimming work, ditching and shouldering, which cost more per cubic yard and are more difficult to estimate exactly.

The draining of the soil is the most important thing in road construction, because the bearing power of the soil depends upon the moisture it contains. In this country this question is far more important than in the southern countries, owing to the nature of the climate.

The soil is soaked by rain-water and by ground-water. The rain-water should be disposed of as quickly as possible by a good, substantial system of ditches, gutters and culverts. Deep ditches should be avoided as much as possible and gutters substituted. Deep ditches are only necessary along flat stretches of road in order to get the necessary slope to cause a quick and complete drainage of water. The minimum slope to be given to ditches should be 5 ins. in 100 ft. Stagnant water should never be found in a ditch.

The greater slope depends upon the resisting power of the soil to abrasion by water and should never exceed such power.

The slopes of the sides of the ditches should be regular and as nearly as possible 1½ ft. horizontal to 1 ft. vertical. It is very difficult to attain this in a flat country where ditches have sometimes to be very deep and wide and would exceed the portion of the right-of-way that it is possible to set apart for them. In such cases rip-raps have to be resorted to. Gutters along hills should be paved with cobblestones whenever the soil is not hard enough to resist abrasion by running water.

Foundation

Tile underdrainage with good outlets is generally to be preferred to deep ditches for disposing of the ground water. Road underdrainage should be made in the same way as in the case of field drainage. Tiles should be laid under the sides of the road rather than under the centre, and should be disposed so as to intercept all water coming from the neighboring fields before they enter the right-of-way. It is important that good and frequent outlets should be provided. Underdrainage, in order to be a permanent and useful work, should be done with the greatest care. It is very difficult to drain a road effectively and completely, and in many cases it is impossible to get the ground water out. Generally, although the soil is dry, its bearing power is not great enough to stand concentrated wheel loads and it is impracticable to sufficiently consolidate it; sometimes a sufficient and effective underdrainage is impossible, and then it is necessary to resort to the use of a foundation in order to distribute the concentrated wheel loads over a wider surface.

The foundation plays the same role in the case of roads as ballast in the case of railways. It is generally assumed that the downward pressure follows a line at an angle of 45 deg. from the horizontal and is distributed over an area equal to the square of twice the depth of the total thickness of the surfacing and of the foundation. This is merely an assumption, but it is approximate enough in practice, and it has been found that the thickness of the foundation plus the thickness of the surfacing should not be less than 9 ins. in common soil for steel tire traffic.

A non-porous soil drained of ground-water will support a load of about 4 lbs. to the square inch; that is, about 1,300 lbs. per square inch applied to the surface of a coating 9 ins. thick per lineal inch of wagon tire. In practice a load of 700 to 800 lbs. per lineal inch of tire is assumed; that is, 2 to 2½ ins. per square inch on the substructure with a 9-in. thick surfacing including the thickness of the foundation.

Many good surfacings give bad results owing to the lack of a substantial foundation. For a soft tire traffic a foundation is not so necessary as for the traffic of wagons with narrow tires and without springs, the impact of which is very damaging to roads.

The foundation should be composed of stones not larger than 4 ins. and a filler in the voids is to be recommended whenever it is not very expensive. Gravel, as in the case of the railways, gives a good foundation and is even better than stone. Telford foundation should be resorted to only in case of necessity. Flat stones should not be used.

Waterways

Foundations are of the class of permanent works mentioned above. Bridges and culverts should also be so constructed as to be considered worthy of the same class.

Good concrete is well adapted for this kind of work. Concrete pipes should not be used in naturally wet clay soils, especially under heavy embankments. They should be of ordinary thickenss and of a diameter not larger than 30 ins. under embankments higher than 14 ft. In these two cases box culverts would be preferable. Sand cushions should be employed to protect them against rock. It is absolutely necessary to give the head walls a firm seat, especially in clay soils and when the pipes are under an embankment. Concrete slab bridges are very useful as well as concrete girder bridges. The maximum economical span of a slab bridge is about 15 ft. and of a girder bridge between 15 and 30 ft. or more. Under high embankments arch culverts should be used.

Concrete trestle bridges are especially recommended for use on rivers where numerous deep gullies are found, as this type of bridge spans them very economically and artistically, thus dispensing with heavy embankments and deep cuts. The latter ought always to be avoided in this country on account of snow.

Many difficulties are encountered in fixing the dimensions of the culverts because the road engineer has, when deciding, to deal with the farmers. The same difficulties are met with when straightening tortuous, crooked roads and improving curves. These difficulties are not technical, but are of common occurence in all countries, being unpleasant and unavoidable. The greatest care should be taken in the planning and construction of bridges and culverts for which the same general rules have to be followed as in the case of railways and of first class concrete work.

Road Surfaces

The cost of the permanent work, that is, of the part of the outlay permanently invested in the case of roads, is a smaller fraction of the total cost than is generally supposed. Except in special cases, it never exceeds one-quarter or one-third of the cost of the surfacing proper, and in the case of special wearing coats this proportion is still smaller; consequently, great care should be taken in the choice and the laying of this part of the road which is short lived and so expensive.

The following points should be taken into consideration when making a choice:

(1) Not to attempt to risk surfacings on a substructure which is not sufficiently firm with or without foundation. Waterbound macadam is not excepted. (2) Not to use surfacing in places where floods or other causes could damage same. (3) Not to use costly surfacing when a less costly could reasonably do as well for the number of years the less costly is supposed to last (4) Not to use costly surfacing when the amount of the total sum of the first cost of the sinking fund and of the maintenance of the said surfacing is higher than with a less costly wearing coat which would do as well.

There is a great variety of surfacings. Leaving aside the earth, sand, slay, clay and ordinary gravel roads which are, as previously stated, very convenient in the majority of the rural roads where traffic is only local and light, the principal surfacings for highways and rural roads are: Waterbound macadam and waterbound gravel macadam; asphaltic macadam, penetration method; asphaltic concrete, mixing method; tar macadam, penetration method; tar concrete; cement concrete surfacing, penetration method (Hassam process); cement concrete surfacing, mixing method; and vitrified brick.

This is a rough classification. Many attempts have been made elsewhere to properly classify and name the road surfacings, but a complete understanding has not yet been arrived at. Of course, the composition of aggregate used with bituminous or tar cement, for instance, in the mixing and penetration methods, varies greatly and sometimes there is little difference between the aggregate used in the two methods. The names of the surfacing are very numerous, depending on some process in the execution of the work and on the nature of the cement and aggregate used.

Apart from the above surfacing some chemical product, such as rocmac, are found on the market, the function of these being to bind or help to bind stone in the macadam.

Tar, bitumen oils and other chemical or residual products such as calcium chloride and glutin should also be mentioned. Their functions are to protect the road surfacings against the wheels of vehicles, to give them a longer life and to lay dust. These preventives have to be renewed more or less frequently.

The author is merely speaking here of the surfacing and preventives generally used in rural road and highway work and not of the still more expensive paving used in cities.

Now what is to be said in regard to all the above named surfacings? There are such great and important interests concerned in bitumen, tar and cement surfacings, success and failure are in fact so mixed up and the experiments, as reported, have given such widely varying results, that it would be very difficult to give a categorical opinion.

Economic Considerations Involved in the Selection of Surfaces

With the economical aspect of the question in view the following conclusions can be drawn:

There is not at present any surfacing good for general purposes. Automobile traffic requires certain qualities for surfacing, and the narrow steel tires, heavily loaded wagons and motor trucks need others.

All kinds of surfacing can be used with advantage if judiciously and suitably chosen, well laid and maintained.

All surfacings require to be maintained with the greatest care.

A combination of steel tire and of soft tire traffic in different proportions requires in each case specially appropriate surfacing.

Bituminous macadam and bituminous concrete macadam, as well as tar, are very suitable for automobile traffic.

Experiments on concrete roads point towards a more general use of concrete surfacing, which does not seem to be affected by a cold climate.

Waterbound macadam, well built, is good for rural roads where automobile traffic is not heavy. Tarring and oiling lengthen its life and allow a medium heavy automobile traffic on it.

All that has been said above presumes that the substructure of the road has been sufficiently drained, that a substantial foundation has been provided for, and that the sum of the thickness of the foundation and of the surfacing are in keeping with the nature and the dryness of the substructure. The road is also supposed to be maintained with care.

In choosing a surfacing the following should be taken into account: (1) The nature and importance of the traffic both present and future; (2) the first cost of the surfacing; (3) the probable life of the surfacing; (4) the cost of its maintenance.

Such information is now easily obtained, and by adding in each case the interest on the first cost, the annual annuity for depreciation fund and the probable annual cost of maintenance of two or more surfacings, the total will indicate the one to be chosen. The first cost should be established as first class.

It may be added here that bituminous and tar surfacing require very great care and experience to be laid properly and that it is more difficult to lay them in this country than in a dry climate.

The annual period of work in the Province of Quebec is about 100 working days; rainy days are frequent as well as variations of temperature, which are at the same time very great.

For a good bituminous and tar surfacing the stone must be dry and not very cold when cement is added. The degree at which the bitumen or tar is to be heated depends to a certain extent on the temperature of the stone and of the atmosphere, and in the autumn the weather is often wet and cold.

Waterbound Macadam

With waterbound macadam, as well as other pavings and especially concrete paving, the quality of the stone plays an important role. Soft stone should be avoided as much as possible.

In the Province of Quebec trap and good rock for road purposes are scarce. Field stones are generally employed and the quality varies greatly as they are generally mixed with bad stones. Sandstone of inferior quality is very common; in some districts a kind of bad granite is found, while gravel and quarries with good material for road purposes are scarce.

For waterbound macadam, the author advocates the two-course macadam—bottom course, 4 ins. loose stones of 2½ ins. ring, well rolled with a steam roller of at least 10 tons, no filler; top course, 4 ins. loose stones of 2½ ins. ring, an appropriate binder entered dry in the course with broom and roller in as great a quantity as possible. The first layer of the binder should be applied before the rolling is begun, and when it is not possible to enter more binder without the roller spraying is resorted to.

The road should be sprinkled until saturated, the sprinkler being followed by the roller. More screenings must be added if needed, and the sweeping, sprinkling and rolling continued until a grout has been formed of the screenings, stone dust and water to fill all voids and form a wave before the wheels of the roller. After that, enough screenings should be spread over the macadam to leave a wearing surface at least three-eighths of an inch thick.

With limestone a coarse-grained sand, as well as the dust of the crusher, is good, but with granite a limestone binder is generally required. In some districts of the Province only sandstone is available. A limestone binder would be suitable with these stones, but, unfortunately, in these districts no limestone is found, and in such cases the dust from the crusher or the sand is of no value and it is impossible to bind the macadam. Thus the only way to obtain a first bond is to use clay and the traffic does the rest, but for two or three years it is necessary to keep the ruts filled and the surface even. Experience shows that it is possible to obtain good results in this way.

The crown of the macadam is generally ¾ in. for a 16-ft. wide surfacing; for a bituminous or tar surfacing ½ in. is enough; for concrete ⅛ in. is suitable.

The choice of a macadam as a surfacing depends not only upon the nature and the importance of the traffic, but also on the quality and the price of the stone. When the stone is of bad quality and dear, it is often more economical to use a more expensive surfacing. In the opinion of the author, the best macadam would be of one-sized stone 2½ ins. ring, with an ordinary soil, a total thickness of about 9 ins. comprising the foundation; also macadam stone should not be mixed with an undue quantity of smaller stones or sand. For a wearing course such a mixture containing too great a proportion of small-sized stones and of screenings is not suitable. As a rule it is not uniform, the larger and smaller sizes have a tendency to separate and, if not mixed with care and laid with shovels, the resulting macadam will have a very irregular wearing quality, and ruts and depressions will consequently follow.

It is very difficult to obtain the one-sized stone at a suitable price in the Province of Quebec because few regular quarries sell macadam stone. It is necessary to use transportable crushers, but these give many flat chips which must be utilized. Meanwhile, everything should be done in order to obtain the standard cubical uniformly sized stone.

The preventives mentioned above are serviceable in many cases, but their cost compared with results is rather high and generally have to be applied at least every year. Tarring, however, has given very good results.

The question of the width of the surfacings is not yet completely settled. Meanwhile experience shows that a width of 16 ft. is suitable for a provincial road and for less important roads 14 ft. is convenient. Shoulders should have a width of at least 4 ft.

Financing Road Improvements

The advent of automobiles, although an important factor in the question of roads, does not particularly affect the rural roads because automobiles will not for some years increase in such number in rural districts as to cause apprehension to the farmers on account of additional expense in maintenance. It only affects such roads in the sense that automobilists ask for better rural roads; while the difficulty lies in the fact that they desire many highways crossing the country which the farmers contend are not necessary to them and which they will not maintain. Who then is to pay?

The improvement of rural roads will benefit the whole country, as well as the farmers, the municipalities and the automobilists.

The provincial highways will also benefit the country, the farmers and the automobilists.

It thus seems justifiable to divide the cost of improvement and maintenance of the roads of the Province between the three interested parties.

What is to be the proportion for each of them? This is a very intricate question, but one which can be solved.

For speedy work, money is not at hand here as elsewhere. The system of long term bonds in the United States came first on the assumption that the next generation would benefit by the improvement as well as the present one. But complaints soon arose. One thing had been overlooked, and that was the difference between permanent work and passing or short lived work.

For permanent work long term bonds can be used. Short lived work constitutes the larger proportion of surfacing. A good bituminous surfacing is said to last from 10 to 15 years with a moderately high traffic in spite of the maintenance. Consequently, for such surfacing only 10-year bonds would be advisable.

For this kind of surfacing, which on account of its high first cost is chiefly used on highways with an important traffic, long-term bonds should be avoided because, in spite of maintenance, long stretches have to be renewed at the same time. A macadam well maintained and without automobile traffic will last a long time, as has been proved by many examples in the old countries, provided the maintenance is complete and effective, the material for macadam being generally at hand and good road men being found easily along the road and put in charge of the work. In such cases longer bonds are to a certain extent reasonable.

Large Works Completed by the C.P.R.

In spite of the depression from which all interests suffered more or less, even before the war broke out, it may be interesting to recapitulate the outstanding features of the work carried out by the C. P. R. during the present year from January to date on its whole system.

At McAdam Junction the C. P. R. recently completed a new machine and erecting shop and added over one mile of new storage tracks.

A fireproof elevator with a capacity for 1,000,000 bushels with an up-to-date power plant was completed this summer at West St. John, not to speak of great improvements to the terminal facilities. The improvements at the passenger and freight terminals at the Windsor station are marked by bulk and efficiency. The train shed, which is just completed, is one of the largest of the most modern types now in use. At the same time the improvements at Place Viger, which have been in hand for three years, are now completed. These, in their entirety, of station, hotel and trackage, cost nearly $5,000,000.

The Union station at Quebec has been commenced. There were the double track bridge at Lachine which cost nearly $3,000,000; the new Lake Shore Line which was opened for traffic in June.; the new station and viaduct at Toronto which are only held up temporarily; the extension of the Kippewa Branch line 10 miles in a northerly direction; a 30-mile extension from Expanse to a junction with the Weyburn-Sterling branch of the C. P. R., and which will be completed this fall; the line between Swift Current and Empress, a distance of 112 miles, and which will be completed this year; the main line cut off from Swift Current to Bassano of which 150 miles are completed; the 78 miles of the C. P. R. branch from Lacombe to Kerrobert, a new extension; the operation of the Alberta-Central Railway to Lochern, a distance of 65 miles from Red Deer; the great tunnel at Roger's Pass, and of which one mile of the pioneer tunnel has been completed; the C. P. R. depot and terminal offices at Vancouver; the Kootenay Central which is now open for traffic, from Golden, 60 miles south. Work on this road is being pushed vigorously on the line to join up Golden and Colvalli; the opening of the Esquimalt and Nanaimo line from Parksville junction to Courtenay.

The C. P. R. is interested in the Kettle Valley Railway, and in connection with the same it is building a line from Midway to Penticton—a distance of 134 miles, 76 of which are already open for traffic. A line from Penticton to Osprey, 41 miles in length, has been completed, and work has been commenced on a new line between Osprey Lake and Princeton. The Kettle Valley Railway is also building a line 54 miles in length between Hope and Otter Summit. A part of the track has already been laid.

In addition to all this, which is merely hinted at, and which is a record of eight months, the C. P. R. has continued its policy of double tracking all the way through.

In the annual report of the Deputy Minister of Public Works for Alberta it is shown that 316 wooden bridges and 16 steel spans were built by the Department during 1913. Repairs to bridges numbered 98. A large amount of trunk road work was completed. Record is made of the completion of the Parliament Buildings at Edmonton, the erection of the Government House at Edmonton, the land titles building at Edmonton, and agricultural schools at Olds, Claresholm and Vermillion. The work in the surveys branch showed an increase over previous years.

Paving Brick Manufacturers at Buffalo

The 11th annual meeting of the National Brick Manufacturers' Association held at Buffalo recently was attended by upwards of two hundred and fifty manufacturers and others interested in municipal and highway work. The attendance included many city and county engineers, besides a good representation of the engineering and technical schools. A number of trips of inspection were made over the Erie county highway, which furnished an excellent opportunity for the study of brick pavement construction. The various stages of the work were discussed in detail en route. A conference held between the Brick Committee of the American Society of Municipal Improvements and the manufacturers developed many interesting suggestions and resulted in a recommendation for factory inspection of brick for abrasion loss. The election of officers resulted in the return of the President, Mr. Chas. J. Deckman, Cleveland, and also of the Secretary, Mr. W. P. Blair, and Assistant Secretary, Mr. H. H. Macdonald, both of Cleveland.

Personal Mention

Professor W. C. Rowse, a graduate of Perdue University, has been appointed Professor of Mechanical Engineering in the University of Manitoba.

The marriage of Mr. C. P. Waterous, Superintendent of the Waterous Engine Works Company, St. Paul, Minn., and Miss Fanny Nagle, daughter of Mrs. F. A. Nagle, 61 Chesterfield Avenue, Westmount, was celebrated in that city on September 16. Mr. Waterous is the grandson of the founder of the well-known Waterous Engine Works Company, Limited, Brantford, Ont., of which the St. Paul plant is a branch.

Mainly Constructional

East and West—From Coast to Coast

It is affirmed that there will be no cessation of construction on the new $5,000,000 plant of the Dominion Shipbuilding and Drydock Company, Limited, at North Vancouver, B.C.

The Ford Motor Company's factory on Christie Street, Toronto, is well advanced towards completion. The total cost of the building is $250,000. The general contractors are the T. W. Mack Construction Company, of Toronto.

The new stadium for McGill University, Montreal, is in course of erection. The architects are Messrs. Nobbs & Hyde, and the general contractors Messrs. L. A. Ott & Company, both of Montreal. The estimated cost is $100,000.

The erection of the Sacred Heart Cathedral at Prince Albert, Sask., is proceeding satisfactorily. The new edifice will be 162 ft. by 75 ft. in dimension, of brick and stone construction. The estimated cost is $150,000. The architect is Mr. A. G. Creighton, of Prince Albert.

Mr. K. Nakamura, an eminent Japanese civil engineer, was a recent visitor at the Grand Trunk headquarters in Montreal. Mr. Nakamura, who is with the South Manchurian Railway Company, has been touring the world with a view to acquiring railway engineering pointers.

The Burrard Inlet Tunnel & Bridge Company, Limited, has had no meeting since the war broke out. Plans for its $2,000,000 bridge have been taken under advisement and are now being adjudicated upon by Ralph Modjeski, at Chicago, Ill. Contracts will probably be let later.

At Niagara Falls, roofing is now in progress on the chain factory which is being erected by the Dominion Chain Company, at a cost of $150,000. The building is two storeys high, of reinforced concrete and steel construction. Mr. E. D. Pitt, of Niagara Falls, is the architect.

At Victoria, B.C., operations are in progress on the First Presbyterian Church, which is being erected at a cost of $125,000. The architect is Mr. J. C. M. Keith, and the general contractors are Messrs. Stevens Bros., Victoria. It is hoped to have the building completed by May next.

Announcement is made that the Proctor-Gamble Company will start work on the construction of their new $1,000,000 plant at Hamilton within the next month. All orders for the supply of building material will be placed locally. The firm expect to employ three or four hundred men at the outset.

Mr. J. H. McDowell, of Montreal, is the architect and Mr. F. Hoadley is the engineer for the new theatre which is to be erected on St. Catharine Street, Montreal, at a cost of $200,000. The building will be of brick and terra cotta construction. Mr. Maurice Wolfe, of Montreal, is interested in the project.

At Winnipeg, steel work is advancing rapidly on the Coca Cola Company's new warehouse which is being erected on Bannatyne Avenue at a cost of $550,000. The general contractors are Messrs. Jas. McDiarmid Company, Winnipeg. The Manitoba Bridge & Iron Works, Winnipeg, are doing the iron work.

The British Columbia Steel Company, Limited, has completed plans for the establishment of a $200,000 steel plant at Bridgeport, B.C., and the stock is now on the market. The company states that it will shortly commence building operations. The head office of the company is at Vancouver, B.C., and many prominent business men of the city, including Francis Leighton, general manager of the Vancouver Engineering Works, Limited, are named as provisional directors.

Operations are proceeding on the erection of a factory which is being erected at Medicine Hat for the Saskatchewan Iron & Bridge Works. The steel work has now been completed. The structure will be 40 ft. high, 200 ft. by 100 ft. in dimensions, of steel and brick construction. The estimated cost is $100,000.

Announcement is made that operations are to be started on the erection of a steel manufacturing plant at Ojibway, Ont. (near Windsor) for the United States Steel Corporation, of New York City. The estimated total expenditure involved is $20,000,000. A branch of the Essex Terminal Railway is to be laid to the site of the plant.

Messrs. Geo. H. Gooderham and G. F. Beer, of Toronto; G. G. Marlott, of Oakville; M. C. Smith, of Burlington, and T. W. Jutten, of Hamilton, have been appointed a special commission to make arrangements for the building of the concrete roadway from Toronto to Hamilton. Mr. Gooderham is chairman. The estimated expenditure is $600,000.

The various municipalities concerned are interesting themselves in the proposal to have the Ottawa-Prescott road construction started without delay. Controller Champagne, of Ottawa, was in Toronto recently interviewing Hon. Dr. Reaume and other provincial authorities in this connection. The idea is to get the work under way in order to provide employment during the winter.

At New Westminster, work is progressing on the harbor improvement scheme, and it is expected that the new wharf of the city on Front Street will be finished in about three weeks. The total cost of this work, including the cost of the construction plant, is estimated at $19,283. Work done last month cost $30,000, leaving the sum of $180,716 to be still expended out of the half million dollar by-law.

The award of contracts for the proposed soap works to be established by the Royal Crown Soap Works, Limited, of Vancouver, B.C. (closely identified with Lever Bros., Port Sunlight, England), on the south shore of Burrard Inlet, near the Second Narrows, has been deferred on account of the war situation. Bids were closed nearly two weeks ago. The enterprise was to have been financed in London and the plans called for the expenditure of $250,000.

Mr. F. H. Herbert, a well-known architect who had been practising in Toronto for a quarter of a century, died last week. The deceased gentleman was born at Bath, Eng., forty-nine years ago and came to Toronto at an early age, studying his profession under the late Mr. Ough. Mr. Herbert was the architect for the Mutual Street Arena, Toronto, but he is best known as the designer of many important industrial buildings throughout the province.

Construction is well advanced on the large dyke over the Falcon River which is being built in connection with the Greater Winnipeg Water Scheme. The contractors are Messrs. Tomlinson & Fleming, and the cost of the work is placed at nearly $121,000. The dyke is for the diversion of the Falcon River and requires an embankment 5,000 ft. long and a channel 3,000 ft. long, 35 ft. wide and 7 ft. deep. The contract calls for the removal of 30,000 cu. ft. of earth.

Work on the new bank and office building which is being erected at Winnipeg by the Quebec Bank, is nearing completion. The structure is 108 feet by 62 feet in dimensions, and contains four storeys and basement. The construction is steel, brick and reinforced concrete. The architects are Messrs. Brown & Vallance, and the general contractors Messrs. Carter-Halls-Aldinger Company, both Winnipeg firms.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Eedford, Que.
By-law has been carried and tenders will be called next spring in connection with extensions to Waterworks, estimated to cost $35,000.

Previous tenders for construction of macadam roads were unsatisfactory, and new tenders will be called in about two weeks. Work is estimated to cost $23,000.

Bridgeburg, Ont.
Queen Victoria Park Commissioners will receive tenders until October 5th for construction of concrete roadway with necessary drainage through villages of Bridgeburg and Fort Erie. Distance approximately 8,500 feet. Plans and specification at Administration Building, Queen Victoria Park, Niagara Falls, Ont. Mr. John H. Jackson, Niagara Falls, is Superintendent.

Bridgetown, N.S.
Ratepayers are voting on by-law seeking authority to construct sewer and water extensions at estimated cost of $3,200. Mr. Harry Ruggles is Clerk.

Chatham, Ont.
City Council has had plans drawn for laying 9,150 sq. yds. concrete pavement. Estimated cost $12,500. Work will be day labor under supervision of Mr. F. P. Adams, Engineer, City Hall. Mr. W. G. Merr is City Clerk.

Hamilton, Ont.
Tenders will be received by Mr. A. F. Macallum, City Engineer, for the following work in connection with laying of Cement Sewer Pipe at an estimated cost of $140,000:—240 ft. 60-inch pipe; 2,410 ft. of 54-inch pipe; 256 ft. of 48-inch pipe; 480 ft. of 33-inch pipe; 1,680 ft. of 30-inch pipe; 1,100 ft. of 30-inch half-section Cement Pipe.

Hawkesbury, Ont.
Town Council contemplates construction of Sewers and Water Mains this fall.

L'Original, Ont.
Work is to start on construction of 4,000 lineal feet of Concrete Sidewalks for Village Council. Estimated cost $2,500. Kelmer & Winshanley, Morrisburg, are General Contractors.

Leamington, Ont.
Tenders will probably be called shortly for construction of Sewer for Town Council, estimated to cost $35,000. Mr. John A. Baird is Engineer; Mr. R. M. Selkirk, Clerk.

Work on construction of 1⅝ miles of Rocmac Pavement has been started by Rocmac Roads Limited, 74 King Street East, Toronto.

Peterborough, Ont.
City Council will invite tenders shortly for construction of concrete sewer outfall. Mr. S. R. Williams is Clerk and Mr. R. H. Parsons Engineer.

Port Hope, Ont.
Town Council has agreed to carry out improvement to Waterworks system in form of extensions to Intake Pipe as suggested by Provincial Board of Health. Mr. J. W. Saunders is the Clerk.

Regina, Sask.
City Council is contemplating extension to pump house at sewage disposal works, estimated to cost $5,000. Mr. F. McArthur is Engineer.

Souris, P.E.I.
Tenders are to be called next spring in connection with installation of sewage and water system in public buildings, for Dominion Government Department of Public Works. All information may be obtained from Inspector of Buildings, Mr. J. J. McDuff, 46 Bayfield street, Charlottetown, P.E.I.

Sussex, N.B.
A large number of sewers are to be erected next year by the Town Council. Mr. Grey Murdock, Carnarthen Street, St. John, is Engineer; Mr. W. D. Turner, Clerk.

Tignish, P.E.I.
Construction of sewer drain from Public Building to Seashore (approximately one mile) for Dominion Government Department of Public Works, is likely to start next spring.

Toronto, Ont.
Tenders close October 13th for Construction of Sewers on fifteen Streets. Plans, etc., are at Office of Works Dept., City Hall.

The following gentlemen have been appointed by Ontario Cabinet a Special Commission to carry out construction of $600,000 roadway from Toronto to Hamilton:—George H. Gooderham, M.P.P. (chairman), Toronto; G. F. Beer, Ryrie Building, Toronto; C. G. Marlott, Oakville; M. C. Smith, Burlington; and T. W. Jutten, Hamilton.

Mr. R. C. Harris, Commissioner of Works, has recommended pavement on a number of streets, estimated at the following cost: Asphalt, $216,412; brick block, $55,853; bitulithic, $32,615; wood block, $4,056, concrete curbings, $5,042.

Works Commissioner Harris will recommend the laying of Cement sidewalks on several streets at estimated cost of $53,000.

West Zorra, Ont.
The following contracts have been awarded for construction of drain for Township Council: General Contractor, R. H. Alexander, R.R. No. 2 Embro, $2,086.70. Contract for supply of tile has been awarded to F. O. Campbell, St. Mary's, at $1,600.

CONTRACTS AWARDED

Regina, Sask.
City Council has awarded contract to Thomas Gibson & Company, 1006 Union Trust Building, Winnipeg, for 50,000 feet of lumber at $19 per M., in connection with construction of plank sidewalks on various streets. Work will be done by day labor.

The contract for construction of additional filter beds in extension to sewage disposal works has been awarded by City Council to O. W. Smith, 4 Peart Block, at $19,142 and to McKenzie, Hazel Company, Regina, for 1,200 cords of field stone at $9 per cord f.o.b. Regina. Extension scheme is estimated to cost $50,000.

Toronto, Ont.
Board of Control has awarded the contract for supply of 232,000 Dunn Wire-Cut Lug Blocks for paving, at $31.50 per M., to F. B. Goodman, 464 Markham St.

Winnipeg, Man.
Greater Winnipeg Water District has awarded the following contracts in connection with Construction of Aqueduct at estimated cost of $6,142,640; Messrs. J. H. Tremblay, Limited, 814 Sterling Bank Bldg., $945,945; Messrs. T. Kelly & Sons, 504 Lindsay Bldg., $1,301,485; Northern Construction Company, 606 Union Bank Bldg., and Carter, Hall & Aldinger, 1010 Union Bank Bldg., $3,895,210.

Railroads, Bridges and Wharves

Chatham, Ont.
Plans are in progress for construction of 16 concrete and Steel Bridges, 35 ft. by 16 ft. span; also dredging work. Estimated outlay $84,000, for City Council and Dover Twp. Mr. W. G. Merritt is clerk and Mr. Geo. A. McCubbin, 135 King Street West, Engineer.

Dundas, Ont.
The Town Council is having plans prepader for construction of steel bridge to be erected over Court Street.

Dover Township, Ont.
Work is to commence on construction of Steel and Concrete Bridge over Mill's Drain and Chatham Townline for Township Council. Work will be done by day labor. Mr. Jno. Welsh, 94 Grand Avenue W., Chatham, is Clerk, and Mr. W. G. McGeorge, 153 Queen Street, Chatham, Engineer. Work will be done by day labor.

General contract for erecting steel and concrete bridge over Gowrie drain of Big Point Road has been awarded by Township Council to Chatham Bridge Company, 206 Inhes Avenue, Chatham.

Hull, P.Q.
Ontario Electric Railway Company is contemplating extension of its Street Railway System in this town. Mr. F.

D. Burpee, Albert Street, Ottawa, is Superintendent.

Hamilton, Ont.
City Council has in contemplation scheme to erect Bridge, 750 feet long, at Burlington Heights, in connection with Toronto-Hamilton Concrete Roadway. Mr. A. T. McCallum is Engineer.

Lacombe, Alta.
After completion of fencing, work on Electric Railway will stop for the year. 31 miles of grading has been completed and culverts placed. 26,000 tithes are required. Farcombe & Inkster, Sheppard Block, Edmonton, are Engineers. D. S. Hogan, Edmonton, general contractor; owner, Lacombe & Blindman Valley Electric Company.

Port Perry, Ont.
Dominion Government Department of Public Works is contemplating construction of public wharf, concrete construction, at estimated cost of $5,000. Mr. Vickery is the Engineer.

Richibucto, N.B.
The contract for extension to breakwater has been awarded by Dominion Government Department of Public Works, to Engineers and Contractors, Limited, 105 Water Street, St. John, (Manager E. R. Reid). General contractor will require equipment, including hoists, mixers and cars. Work will start shortly.

Uxbridge, Ont.
By-law to raise $202,665 for construction of Electric Railway for Provincial Hydro Commission and Uxbridge Municipality, will be submitted and voted on, October 19th.

Waterford, Ont.
Hydro-electric Power Commission of Ontario is contemplating construction of Line from Brantford to Waterford via Burford, Scolland and Oakland. It is the intention to build a Sub-Station in Waterford this year. Mr. W. W. Pope, Continental Life Bldg., Toronto, is Secretary, and Mr. F. A. Gaby, Engineer.

CONTRACTS AWARDED

Dover Twp., Ont.
The Township Council has awarded contract for construction of two Steel and Concrete Bridges over O'Mara Drain, estimated cost $700, to Mr. W. A. Essan.

Harwick Twp., Ont.
The following contracts have been awarded by Township Council: (1) to erect six bridges and pump house, supply machinery, Park Bros., 165 William St., Chatham; (2) for dredging in connection with Burke Drainage Works, Lakeside Dredging Company, Walkerville. Combined work is estimated to cost $42,000.

West Flamboro, Ont.
Dickson Building Company, Dundas, has been given the contract for erection of bridge for H. O. Smith, 121 Kent Street, Hamilton.

Public Buildings, Churches, Schools, etc.

Edmonton, Alta.
Church building in course of erection for St. Josephs R. C. Congregation, at estimated cost of $6,000, will be completed this year. Mr. Silas G. Guillon, 36 Dominion Bank Building, is the Architect.

Hagersville, Ont.
Work is to start this fall on construction of Roman Catholic Church in which Rt. Rev. J. M. Mahoney, Hamilton, is interested.

Lucan, Ont.
Plans are in progress for construction of Vestibule and Tower, 15 ft. by 21 ft., and 50 feet high, installation of Bell, Electric Wiring and Fixtures, etc., estimated to cost $2,500, for Lucan Methodist church. Mr. J. V. Munro, Bank of Toronto Chambers, London, is the Architect. Masonry will be white brick.

Maisonneuve, Que.
In connection with construction of Church for Maisonneuve Methodist Congregation, Anglins Limited, 65 Victoria Street, Montreal, are taking tenders on mill work, roofing and electrical work.

Moncton, N.B.
General Contractor E. B. Evans, 357 St. Catharine Street West, Montreal, is still receiving tenders for steel mill work, roofing, heating, plumbing, electrical work, ventilating, tile and glass, in connection with construction of $65,000 Church and Sunday School for St. John's Presbyterian Congregation.

North Vermillion, Alta.
Lawrence Point School District, No. 3175, will erect Public School shortly. Mr. Sheridan Lawrence, North Vermillion, is Sec.-Treas.

Notre Dame De Grace, Quebec (Montreal)
Messrs. C. E. Deakin, Limited, 41 Mayor Street, are receiving tenders on electrical work in connection with $175,000 Orphanage to be erected on Decary Avenue for Catholic Orphanage. Building will be stone and brick construction. Mr. A. Paiche, 33 Belmont Street, Montreal, is the Architect.

Quebec, Que.
Plans have been drawn by Mr. P. H. Myrand, Parliament Buildings, for $40,000 Convent to be constructed on Limoilou for Sisters of St. Francois D'Assise. Building will be stone and brick construction.

Regina, Sask.
Wesley Methodist Church has procured site from city for erection of Church on 15th Avenue.

St. Louis De Cuorville, Que.
Plans are drawn for scheme of interior trimming of Parish Church. Mr. P. H. Myrand, Parliament Bldgs., Quebec, is the Architect.

St. Malo, Que.
The painting contract for five-storey Convent for Sisters of Providence, has not yet been awarded. Mr. Chas Paradis, 159 Ste. Therese, is general contractor.

Vancouver, B.C.
Designs close with Secretary, Board of Trade, Nov. 30, for Civic Centre. Buildings are proposed to be located on site as follows:—City Hall, Public Hall and Auditorium, Public Library, Technical College, two Museums and Art Gallery. Conditions of competition, etc., may be ascertained at Office of Secretary, also at MacLean Daily Reports, Ltd., Toronto.

CONTRACTS AWARDED

Winnipeg, Man.
The contract for construction of Library for Board of Control, on Machray and Salter Streets, at estimated cost of $28,000, has been awarded to Messrs. Fraser & McDonald, 512 Gertrude Avenue. Mr. J. W. Semmens, McArthur Block, is the Architect.

National Construction Company, Boyd Building, has obtained general contract for construction of Library on Cornish Park at a cost of $29,331. Building will be stone construction. Mr. S. F. Peters, Phoenix Block, is the Architect.

Business Buildings and Industrial Plants

Broadview, Sask.
Mr. T. G. Lyons has the erection of a $5,000 hotel in contemplation.

Brampton, Ont.
The Sutherland Construction Company, Ryrie Building, Toronto, are open to receive sub-tenders for masonry, carpentry, steel and concrete work and painting in connection with $20,000 Jam Factory for Lindners, Limited, 340 Dufferin Street, Toronto.

Calgary, Alta.
The following contracts have been awarded in connection with extension to Public Market at estimated cost of $12,000: General contractor, W. MacDonald, 231 14th Avenue; heating and plumbing, Campbell & Hillier, 1008 17th Avenue West.

Digby, N.S.
The construction of Dining Room and Cottages, estimated to cost $75,000, is in contemplation by Mr. J. A. Spurr, Digby.

Edmonton, Alta.
Plans are drawn for construction of $28,000 Warehouse on Third Street for Mr. M. A. Miller, c/o architect. Building will be three storey, brick and stone construction. Tenders may be called shortly. Messrs. Hardie & Maitland, Victoria Block, are the architects.

Mr. J. N. Pomerlean, Richeleau Hotel, has had plans drawn for Stores and Offices to be erected on Jasper Avenue and Sixth Street, at an estimated cost of $125,000. Buildings will be four storey, concrete foundation, reinforced concrete, brick and steel construction. The architects are Messrs. Hardie & Martland, Victoria Block.

Hawkesbury, Ont.
Construction of Paper and Board Mill for Hawkesbury Board and Paper Mills, will probably start shortly.

Hamilton, Ont.
Excavating in connection with $1,000,000 Soap Factory for Messrs. Proctor & Gamble, Cincinnati, Ohio, will start immediately. Owners, who are also architects and general contractors, will buy material and superintend construction.

Hagersville, Ont.
The W. A. Tom Construction Company, Limited, Collingwood, Ont., general contractors, are asking for tenders for separate trades in connection with

Tenders and For Sale Department

TENDERS

Will be received up to **October 1, 1914**, for Low Pressure Steam Heating of the Revere House, Markdale, Ont. Plans and specifications may be seen at the latter place or at the office of Forester & Clarke, Architects, Owen Sound. 38-39

Vancouver Civic Centre 1914

The Committee appointed by His Worship Mayor Baxter invite competitive designs for the development of the proposed Civic Centre. Premiums amounting to $500 and $250 will be awarded to the designs placed first and second respectively. The award will be made by independent experts whose decision shall be final. All designs must be delivered not later than November 30th, 1914. Programme of competition and plans may be obtained from the Secretary, Vancouver Civic Centre Committee, care Vancouver Board of Trade, 543 Hastings Street West, Vancouver, B.C. 36-39

Sealed tenders addressed to the undersigned, and endorsed "Tender for Electric Passenger and Freight Elevators, Langevin Block, Ottawa, Ont.," will be received at this office until 4 p.m. on **Friday, October 9, 1914**, for the installation of three (3) standard passenger and one (1) standard freight elevators, in the Langevin Block, Ottawa, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained on application to this Department, at the offices of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Toronto, Ont., and Mr. R. L. Deschamps, Superintendent of Public Buildings, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 21, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—67143. 38-39

City of St. Catharines, Ont.

Tenders for Concrete Bridge Construction

Sealed tenders for the erection of the substructure of the St. Paul Street High Level Bridge, addressed to the City Clerk, will be received until five o'clock p.m. on the **15th** day of October, **1914**.

Principal Items of Work

Excavations	3000 cu. yds.
Concrete masonry in abutments	1850 cu. yds.
Concrete masonry in copings	65 cu. yds.
Timber piles	10240 lin. ft.
Anchor Bolts	7250 lbs.
Steel reinforcement	3600 lbs.

Information for tenderers, plans and specifications may be obtained at the office of the City Engineer, St. Catharines, Ont., on the receipt of a deposit of Five Dollars which will be refunded on receipt of a bona fide tender.

A certified cheque in the amount of $3,000, payable to the City Treasurer, is required to be deposited with the bid, and a construction bond of $10,000 shall be furnished the City by the tenderer to whom the contract is awarded.

The City reserves the right to reject any or all tenders or to accept the tender which would best serve the interest of the City.

W. P. NEAR,
City Engineer.

39-40

Sealed tenders addressed to the undersigned, and endorsed "Tender for Electric Passenger and Freight Elevators, Examining Warehouse, Montreal, Que.," will be received at this office until 4 p.m. on **Wednesday, October 7, 1914**, for the installation of Two (2) standard passenger and Six (6) standard freight elevators, in the Examining Warehouse, Montreal, Que.

Plans, specification and form of contract can be seen and forms of tender obtained on application to this Department and at the office of Mr. R. L. Deschamps, Supt. Public Buildings, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 16, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—67153. 38-39

Construction of Sewers

Sealed tenders, plainly marked as to contents, will be received by the undersigned up to noon of **Monday, October 5th, 1914**, for the construction of sewers on Arlington Avenue, in the Township of York.

Plans and specifications may be seen at the office of the undersigned, 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
Township Engineer.

Toronto, September 30, 1914. 39

Notice to Contractors

Tenders will be received by registered post only addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, October 13th, 1914**, for the construction of the following sewers:—

Argyle Street Storm Overflow Sewer, Sec. No. 2, from Gladstone Ave. and Argyle Street to Brock Ave. and Middleton Street, via Gladstone Ave., Trafalgar Avenue, Dufferin Street, Gordon Street, Sheridan Ave. and Middleton Street.
Bathgate Avenue, Danforth Ave. to 230 ft. north.
Bathgate Ave., 230 ft. north Danforth Ave. to 115 ft. 5 in. north Milverton Blvd.
Belhaven Road, south side Patricia Road to Wrenson Road north.
Conduit Street, Keele Street to Oakmount Road.
Dawes Road, Danforth Ave. to south end.
Glenmore Road, Patricia Rd. to Gerrard Street.
Hain Ave., 800 ft. north Bloor Street to Conduit Street.
Kelvin Ave., Danforth Ave. to south end.
Linsmore Cres., Danforth Ave. to 230 ft. north.
Linsmore Cres., 230 ft. north Danforth Avenue to 119 ft. north Milverton Blvd.
Luttrell Ave., Danforth Ave. to south end.
Scott Street, Esplanade Street to Front Street.
Strathmore Blvd., east side Greenwoods Ave. to Bathgate Ave.
Trent Ave., Danforth Ave. to south end.
Wallace Ave., Campbell to Perth.
Wrenson Road, Belhaven Road to Bowmore Rd.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, September 23rd, 1914. 39

Sales Agents Wanted

Large United States chain manufacturers now represented in Quebec Province want to secure Sales Agents in Ontario, Western Canada and Maritime Provinces for all kinds of logging chain, dredging chain, etc. Apply Box 78, Contract Record, Toronto, Canada. 39-41

Sealed tenders addressed to the undersigned and endorsed "Tender for Engines C. G. S. 'Tyrian,'" will be received at this office until 4 p.m., on **Friday, October 9, 1914**, for one set of inverted fore and aft compound surface condensing engines, cylinders about 20 and 42 inches diameter by 27 inches stroke for 130 lbs. working pressure, delivered at Halifax, N.S., on the wharf next I. C. R. Terminal for a fixed sum.

Specifications and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers at Toronto, Ont., Shaughnessy Building, Montreal, P.Q., St. John, N.B., and at the office of Mr. A. B. Crosby, Halifax, N.S.

Persons tendering are notified that tenders will not be considered unless made on the forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signatures, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 25, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 39-40

Sealed tenders addressed to the undersigned and endorsed "Tender for Boilers C. G. S. 'Tyrian,'" will be received at this office until 4 p.m. on **Friday, October 9, 1914**, for the construction and delivery of two single ended Scotch Boilers 11 feet 6 inches diameter by 10 feet 6 inches long, for a working pressure of 130 lbs. per square inch, delivered at Halifax, N.S., on the wharf next I. C. R. Terminal for a fixed sum.

Plans, specifications and form of contract can be seen and forms of tender obtained at the Department and at the offices of the Dictrict Engineers at Toronto, Ont., Shaughnessy Building, Montreal, P.Q., St. John, N.B., and at the office of Mr. A. B. Crosby, Halifax, N.S.

Persons tendering are notified that tenders will not be considered unless made on the forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Ministtr of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeitcd if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, September 25, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 39-40

Tenders Wanted

Sealed tenders will be received by the undersigned, addressed to John Allan, Mayor, Chairman Board of Control, City Hall, Hamilton, up to 4 o'clock p.m. on **Monday, October 5th, 1914**, for supplying this Corporation with the following quantity of reinforced concrete pipe:—

240 ft. of 60-in. (inside diameter) 6-in. thick.
2410 ft. of 54-in. (inside diameter) 5½-in. thick.
256 ft. of 48-in. (inside diameter) 5-in. thick.
480 ft. of 33-in. (inside diameter) 4-in. thick.
1680 ft. of 30-in. (inside diameter) 3½-in. thick.
1100 ft. of 30-in. (inside diameter) 3½-in. thick.
½ section.

Tenders must be on forms supplied and plainly marked on the outside as to contents.

Specifications and form of tender for the above can be obtained at the office of the City Engineer, Hamilton, where any other information may be secured.

The lowest or any tender not necessarily accepted.

S. H. KENT, City Clerk.
Hamilton, September 28th, 1914. 39

Board of Education

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, October 9th, 1914

for all trades

New Building, Givins Street School

Heat Regulators, Sundry Schools

Local Telephones, Sundry Schools

Concrete Retaining Wall, Balmy Beach School

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer, at his office, in the City Hall, not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

J. W. JACKSON,
Chairman of Committee.

W. C. WILKINSON,
Secretary-Treasurer.
39

Business Buildings and Industrial Plants

(Continued from page 61)

construction of two-storey steel concrete and brick drill hall for Dominion Government, Department Militia & Defence.

London, Ont.
The Fitzgerald Estate, 173 Dundas Street, is constructing new Store Front, fireproof partition, and brick columns. Estimated cost $800. Mr. S. Willis, Oxford and Talbot Streets, is general contractor. Plans have already been drawn.

Moncton, N.B.
Plans are in progress by Mr. R. A. Frechet, Architect, 30 Bonicord Street, for rebuilding car barns for Moncton Tramway & Electricity & Gas Company, which were destroyed by fire some time ago.

Montreal, Que.
Permit to build Blacksmith Shop at estimated cost of $1,000, has been issued to Messrs. Joseph Belisle & Frere, 808c Papineau.

In connection with $200,000 theatre on St. Catharine Street, Mr. F. Hoadley, 6th floor, New Birks Building, Engineer, will take prices on heating, ventilating, electric and vacuum cleaning system as work progresses. Building will be brick and terra cotta construction. Mr. J. H. McDowell, Drummond Building, is Architect.

Niagara, Ont.
The building of stores and departments estimated to cost $4,000, is contemplated by Mr. Wm. Duncan, Morrison Street.

North Sydney, N.S.
The Dominion Government Department of Militia & Defence will invite tenders shortly for construction of the following Military Buildings: one at Louisburg; one at North Sydney; two at Sydney; one at Sydney Mines and two at Glace Bay.

Quebec, Que.
Canadian Pacific Railway Company, Montreal, has commenced work on two Freight Sheds on St. Paul Street, estimated to cost $50,000. Downing, Cook Construction Company, 37A Beaver Hall Hill, Montreal, are General Contractors, Masonry and Carpentry.

Redcliff, Alta.
The contract for erection of Bank and Apartments on Broadway and Third St. for Royal Bank of Canada, has been awarded to Hotson, Leader & Goode, Medicine Hat. Work, which will be two storeys and basement, brick construction, will start immediately.

Southampton, Ont.
Dominion Government has purchased site for erection of Post Office, but work may not be commenced this year.

Sydney, N.S.
A site has been purchased by Mr. A. M. Crofton, 291 Charlotte Street, for erection of four-storey, rough stone, Y M. C. A. on water front. Estimated cost $55,000.

Toronto, Ont.
Tenders are open in connection with Additions to Stores on Delaware Avenue, corner of Bloor, for Mr. D. Ryan, 928 Bloor Street West, at estimated cost of $3,000. Bulk tenders received by owner. Building will be two-and-a-half-storeys. brick construction.

Mr. W. E. Kirkpatrick, 748 Broadview Ave., has obtained permit to erect workshop at estimated cost of $1,200.

Permit has been issued to Mr. F. Waite, 4 Newsham Street, for construction of 2½-storey Brick Store and Detached Residence estimated to cost $2,400.

In connection with $125,000 hotel in course of erection on Bay & Richmond Streets for Mr. J. J. O'Neil, 53 Wellington Street, plans for the marble and tile work are being revised. Mr. J. P. Hynes, 199 Yonge Street, is the Architect.

West Montreal, P.Q.
Anglins Limited, general contractors, 65 Victoria Street, are receiving tenders on mill work, roofing and electrical work in connection with three-storey brick and terra cotta stores, etc., for Mr. J. W. Foster, 43 Westminster Ave.

Windsor, Ont.
A $5,000 Garage is to be built by Mr. Fitzbridges, who will let some trades. Messrs. Leybourne & Whitney, Sandwich Street, are the Architects.

Tenders will be received until October 10th for contract in connection with erection of $8,000 Curling Rink on Dufferin Place for Windsor Curling Club. Building 1½ storeys, concrete block construction, concrete foundation. Mr. J. B. Pennington, LaBelle Building, is Architect.

Plans are being prepared by Don. Smith, Walkerville, Architect, preparatory to erection of $5,500 Garage on Pitt Street E., for Morton & Foweil.

CONTRACTS AWARDED

Montreal, P.Q.
The general contract for one-storey addition to Store on Notre Dame and Bisson Streets, for P. Wright, has been awarded to Mr. James McNeil. Estimated cost $3,000.

The general contract for five-storey addition to Laundry for Toilet Laundry Company, Limited, 425 Richmond Street, at estimated cost of $75,000, has been awarded to Anglins, Limited, 65 Victoria Street.

The following sub-contracts have been awarded in connection with alterations to Stores and Residence on Beaver Hall Hill: Steel, Dominion Bridge Company, roofing, Sibley & Huot, 34 St. Martin Street; plumbing and heating, P. J. Sullivan Company, Limited, 326 Lagauchetiere Street W. Plastering and painting contracts not let. Ramond Construction Company, 46 St. Alexander Street, are the general contractors.

Windsor, Ont.
The contract for Alterations to Store on Oullette Street for Mr. F. H. Laing, has been awarded to Mr. Geo. Goodman.

Residences

Dundas, Ont.
Plans are being prepared in connection with alterations to residence of Walter Boult, King street. Building to be two storeys, artificial stone construction, concrete foundations.

Edmonton, Alta.
Mr. F. Crook, Wadhurst Park, has had plans drawn by Messrs. Hardie & Martland, Architects, Victoria Block, for $55,000 Apartment Block on 17th Street. Proposed building will be three-storey brick and stone construction.

Markham, Ont.
The construction of a $3,500 brick Residence is contemplated by Mr. J. Huffman.

Maisonneuve, Que. (Montreal)
Plans are being altered and separate tenders will be called by Architects, Messrs. Hutchison, Wood & Miller, Royal Insurance Bldg., within two weeks, for construction of $15,000 Residence on Jean D'Arc and St. Catharine, for St. Lawrence Sugar Refineries, Limited, 145 St. James Street.

Montreal, Que.
Work will be recommenced shortly on ten-storey Apartment House on Sherbrooke W., for Mr. E. Maxwell, 6 Beaver Hall Square.

Niagara Falls, Ont.
The construction of $2,500 residence on Ferry Street is contemplated by Mr. M. Abbabot, care E. Davies, River Road.

Ottawa, Ont.
The construction of $5,000 residence on Ossington Street, two-and-a-half-storey, brick veneer, is contemplated by Mr. J. H. Crosbie, P.O. Box 65.

Mr. F. W. Mick, 269 Brazehill, is contemplating building a brick veneer Residence.

Alterations to hall and residence, estimated to cost $3,000, are contemplated by Mr. D. L. Campbell, Driveway West.

Mr. Frank Martin, 20 Roslyn Avenue contemplates erecting $3,000 residence on Pansy Avenue.

The construction of a $6,000 residence on Echo Drive is contemplated by Mr. W. J. Fitzpatrick, 760 Echo Drive.

Quebec, Que.
Tenders are being received by Bernier & Boutet, 20th Avenue, Lamontagne, for roofing, painting, heating, plumbing and electrical work in connection with $6,000 residence for Mr. E. Caron, Domaine Lairet.

Regina, Sask.
City Council has issued permit to Mr. S. H. Nesbitt, 2166 Rae Street, to construct $4,000 Residence on Angus Cres.

Stratford, Ont.
Tenders will be received by Rev. D. J. Egan, Owner, 48 Wall Street, or Mr. Jas. Russell, Architect, 21 Downie Street, for construction of $9,000 Residence, two-storey brick construction.

Sarnia, Ont.
Mr. Daniel Dingwall, 241 Wellington Street, contemplates erecting $4,000 Residence on Lohiel Street.

Mr. Vaughan McDonald, Front Street, contemplates erection of an $8,000 Residence.

Toronto, Ont.
Bulk and separate tenders will be received by Mr. F. Middleton, 33 Austin Avenue, owner, until Oct. 15, for house moving, excavating, concrete and all other trades in connection with Alterations and Additions to Detached Residence. Plans may be seen between 6 and 8 p.m.

Tenders will be called later for smaller trades in connection with $4,000 Detached Residence in course of construction for Mr. J. T. Moore, 30 Brookmount Avenue.

Smaller trades will be sub-let in connection with $5,000 Detached Residence for Mr. D. Hyde, 115 Belhaven Road. Work will be done by day labor. Owner supplies material.

Architect George N. Molesworth, 2 College Street, will receive tenders until October 2nd for partial completion of work in connection with Club House on Sunnyside for Parkdale Canoe Club. Sub-contract will include carpentry, steel beams, painting, roofing and electric wiring.

Mounce Company, Limited, 336 Parliament Street, has obtained permit for Residence on Moscow Ave, estimated cost $1,250.

Tenders for plastering $5,000 Residence on 80 Indian Grove Avenue, for F. Rogers, 1193 Queen Street West, are still open. Building is 2½ storeys, brick construction.

Messrs. Crawford & McClintock, 98 Ferrier Avenue, have obtained permit to construct two-storey Detached Residence, estimated to cost $1,800, on corner of Skipper and Leslie Streets.

West Flamboro, Ont.
Construction of building for Mr. H. O. Smith, 121 Kent Street, Hamilton, may not start until next spring.

CONTRACTS AWARDED

Dundas, Ont.
The following contracts have been awarded in connection with construction of $4,000 Residence, two-storeys, brick construction, for Mr. F. A. Nelson. General Contractor, Mr. Thos. E. Wood; Painting, Mr. S. C. Patterson.

Montreal, Que.
The contract for two flats has been awarded by Mr. A. Fortier, 290 Papineau Avenue, to Messrs. J. B. Gratton, Limited. Buildings will be three-storey, concrete foundation.

Ottawa, Ont.
General contract for additions and alterations to residence for Mr. W. J. Kennedy, 52 Cooper Street, has been awarded to J. B. Younghusband, Spruce Street.

Winnipeg, Man.
Frid Lewis & Company, Somerset Building, have obtained the contract for additions and interior alterations chiefly to residence of Mr. U. H. Bain, Armstrong's Point.

Power Plants, Electricity and Telephones

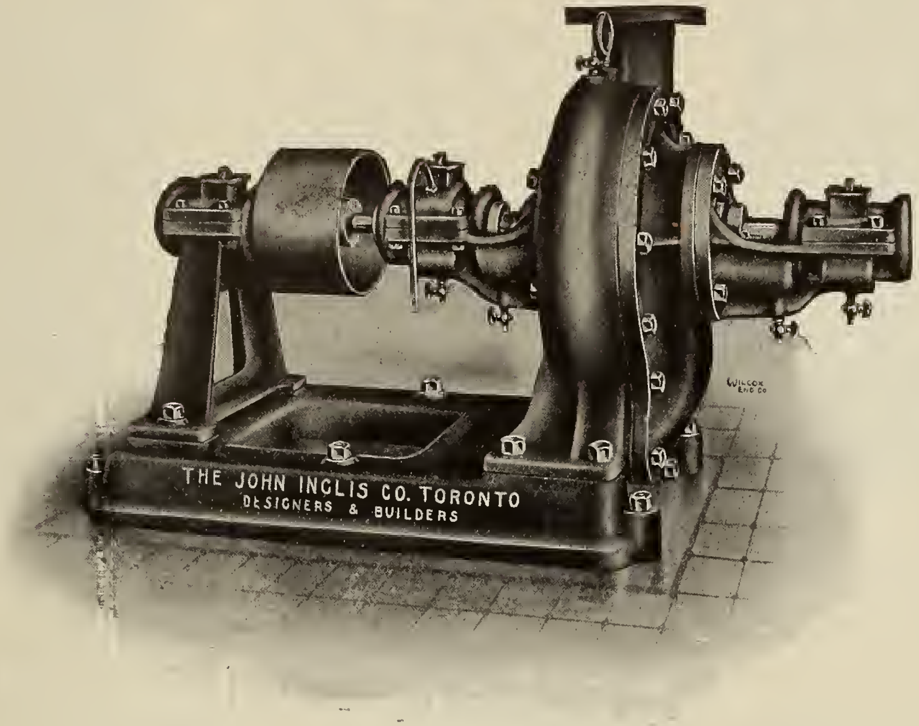
Dundas, Ont.
Hydro-Electric Power Commission of Ontario has in contemplation construction of stub line from Hamilton to Dundas, including inter-switching station and steel towers, set in concrete and carrying two new wires, to replace present poles. Mr. W. W. Pope, Continental Life Building, Toronto, is Secretary and Mr. Gaby Chief Engineer.

Edmonton, Alta.
North Alberta Lumber Company contemplates installing 1,000 h.p. generator for power and lighting in Sawmill.

Fraserville, Que.
Tenders will be called in December or January for additions to Power House including Penstock, Waterwheel, Dynamos and Motors for Town Council. Estimated cost $25,000. Mr. E. Talls is the Clerk.

Ottawa, Ont.
Tenders will be received by Mr. R. C. Desrochers, Secretary Dominion Government Department of Public Works,

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave., Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Ottawa, until 4 p.m., October 9th, for installation of three passenger and one freight elevators in Langevin Block, Ottawa. Plans and specification at office of Mr. Thomas Hastings, Clerk of Works, Postal Station F, Toronto; Mr. L. L. Deschamps, Superintendent of Public Buildings, Montreal, and at Department, Ottawa. Specification at office of MacLean Daily Reports, Toronto.

CONTRACTS AWARDED

New Glasgow, N.S.
The contract for installing steam heating system in West Side School has been awarded to Jos. Stewart, George Street.

Regina, Sask.
North Western Electric, Limited, 107 Kerr Block, has obtained the contract for lighting system in new wing of general hospital.

Miscellaneous

Charlottetown, P.E.I.
Tenders will be called next spring for supply of 150 pews, seating capacity 1,200 people, for Trustees, First Methodist Church. Mr. Henry Smith, Pownal Street, is Chairman.

Niagara Falls, Ont.
Mr. W. Palmer, River Road, contemplates purchasing half-yard, Belt Drive Cement Mixer for block making.

Ottawa, Ont.
Plans are to be drawn at once in connection with the construction of lavatory on O'Connor Street, for City Council. Mr. Norman H. H. Lett is Secretary. Mr. F. C. Sullivan, Castle Bldg., Queen Street, is the Architect.

Penetanguishene, Ont.
Work is to start immediately on construction of cement wall at supply station, Light and Water Commissioners. Wall to be 50 ft. diameter, 12 ft. deep. Mr. W. Blanchard, Penetanguishene, is general contractor.

Prince Albert, Sask.
The painting contract in connection with $150,000 Cathedral on 4th Avenue West, for Sacred Heart Cathedral, has not yet been let.

Business Notes

Colborne, Ont.
Freight sheds belonging to Canadian Northern Railway, which were destroyed by fire, are to be rebuilt.

Copper Mountain, B.C.
A number of workmen's cottages are to be erected for British Columbia Copper Company, Copper Mountain. Superintendent, Mr. Walz.

Collingwood, Ont.
Fire has destroyed evaporator owned by Mr. James Vansise. Loss is reported to be $3,000. No insurance was carried.

Essex, Ont.
Library Board of Town Council is to purchase fittings for new library just completed. Address J. A. Short.

Montreal, Que.
The Clothing and Furniture Stores on St. Catharine and Wolfe streets, owned by H. Cohen, 569 St. Catharine Street E., have been burned down. Loss reported to total $40,000.

Notre Dame, Que.
Owner and general contractor G. T. Ogilvie, 441 Bleury Street, is receiving prices on roofing and painting in connection with two Residences in course of construction on Grey Avenue, at a cost of $40,000.

Quebec, Que.
Shoe factory owned by Messrs. F. & R. Blouvin, Colomb Street, has been burned down. Loss reported at $35,000.

Tenders are invited on painting and plumbing in connection with $4,000 residence on 8th Avenue for Mr. F. Thibault, 8th Avenue, Limoilou.

Mde. Eug. Beland, 138 5th Street, is receiving tenders for $5,000 residence.

A shoe factory owned by Narier & Trudel, of Nelson and Colomb streets, has been destroyed by fire. Estimated loss $50,000.

St. Catharines, Ont.
A number of buildings have been destroyed by fire, amounting to a loss of $14,500 to five owners.

Toronto, Ont.
The City Architect's Department has notified owners of Majestic Theatre, 27 Adelaide Street West, to construct additional fire escapes.

In connection with $7,000 Detached Residence on 186 Balmoral Avenue, for J. G. Fitzgerald, 17 Oriole Gardens. Contracts for heating and plumbing have not yet been let. J. T. Dean, 65 St. Clair Avenue East, is General Contractor.

Permit has been obtained by W. Harrington, 202 Janson Street, to erect two-storey Brick Residence. Estimated cost $1,400.

Mr. S. C. Hurlburt, 74 St. Clements Avenue, has obtained permit for pair of Residences on St. Clements Avenue, estimated to cost $4,600.

West Edmonton, Alta.
Edmonton, Dunvegan & B. C. Railway Company, St. Albert Trail, is building ten frame Residences for employees.

Late News Items

Chilliwack, B.C.
Contract for installation of electrical equipment in Chilliwack Technical School has been awarded to Mr. S. Pugh.

Fort George, B.C.
Estimates are being prepared and tenders will be called immediately for construction of Bridge on Upper Mud River to replace structure recently swept away. It is stated that two additional bridges will be constructed further up the river, estimated to cost approximately $17,000.

Fort William, Ont.
A proposal is now before City Council to construct Rink upon plans by Metal Shingle and Siding Company, of Preston, Ont. Design is semi-circular section built with composite spans, held together with longitudinal purlins and covered with metal. Company has been asked to furnish plans and estimates for Rink. Probable cost about $10,000.

Kamloops, B.C.
Track laying on C. N. R. has been started from Kamloops Junction westward and will be continued to No. 9 bridge, four miles west of Savona. Dominion Bridge Company will there erect No. 9 bridge and track will be laid six miles further to bridge No. 8.

Lethbridge, Alta.
The city will proceed at once with contemplated sewer work, the material for which is already on hand.

London, Ont.
The London Concrete Machinery Company has secured the contract to furnish the city of London with a third yard electric operated Paving Concrete Mixer.

North Vancouver, B.C.
Plans are in preparation by engineers of Dominion Shipbuilding, Drydock & Engineering Company, Canada Life Building, for building of another unit of Company's proposed plant on North Shore. Tenders will be invited almost immediately.

The B. C. Granatoid & Contracting Company have been awarded contract for Concrete Foundations in connection with construction of Additional Unit to Dominion Shipbuilding, Drydock & Engineering Company's plant on North Shore. Excavation work is progressing rapidly.

A Shipbuilding Plant and Drydock, estimated to cost about $5,500,000, for Amalgamated Engineering Company, of Victoria, B.C., will be constructed in the near future. A subsidy was granted recently by the government.

Oshawa, Ont.
Town Council has passed by-law for construction of concrete pavement on King Street, east from Mary to Division Street, as a local improvement, at 87 cents per sq. yd.

Owen Sound, Ont.
The London Concrete Machinery Company has secured the contract to supply one-third yard steam operated Paving Concrete Mixer to the town of Owen Sound.

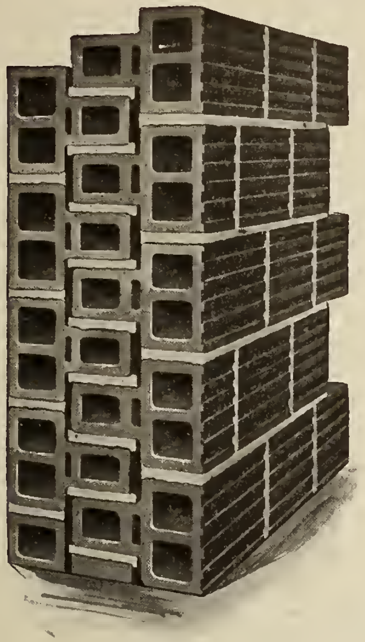
Point Grey, B.C.
Final details and specifications in connection with proposed School at Point Grey are being prepared by Architect R. B. S. Twizell, Metropolitan Bank. Plans call for structure of Collegiate Gothic style, faced with stone and pressed brick. The estimated cost is about $50,000 and it is expected that tenders will be invited as soon as plans are approved.

Port Moody, B.C.
City Council has abandoned proposed installation of Water System and tenders for steel pipe have been returned unopened. This is due to difficulty in financing the scheme.

Saanich, B.C.
By-laws have been provided for (1) paving of main streets of municipality from city limits to outside boundary, money required $450,000; (2) installattion of Distributing System, and providing for future extension, money required $375,000; (3) to provide for purchase of site and construction of School near junction of Tillicum and Gorge Roads, estimated cost $50,000.

St. John, N.B.
Tenders addressed to R. C. Desrochers, Secretary, Department of Public Works, Ottawa, will be received until 4 p.m. Wednesday, October 7, for installation of one standard passenger and one standard freight elevator and one electric ash hoist in the new Post Office.

DENISON



Twelve Inch Wall

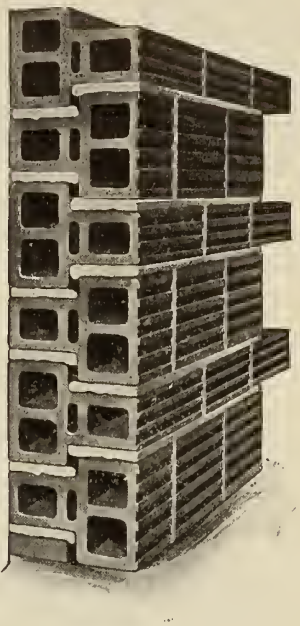
Interlocking Hollow Tile

The one size and shape builds all thicknesses of walls.

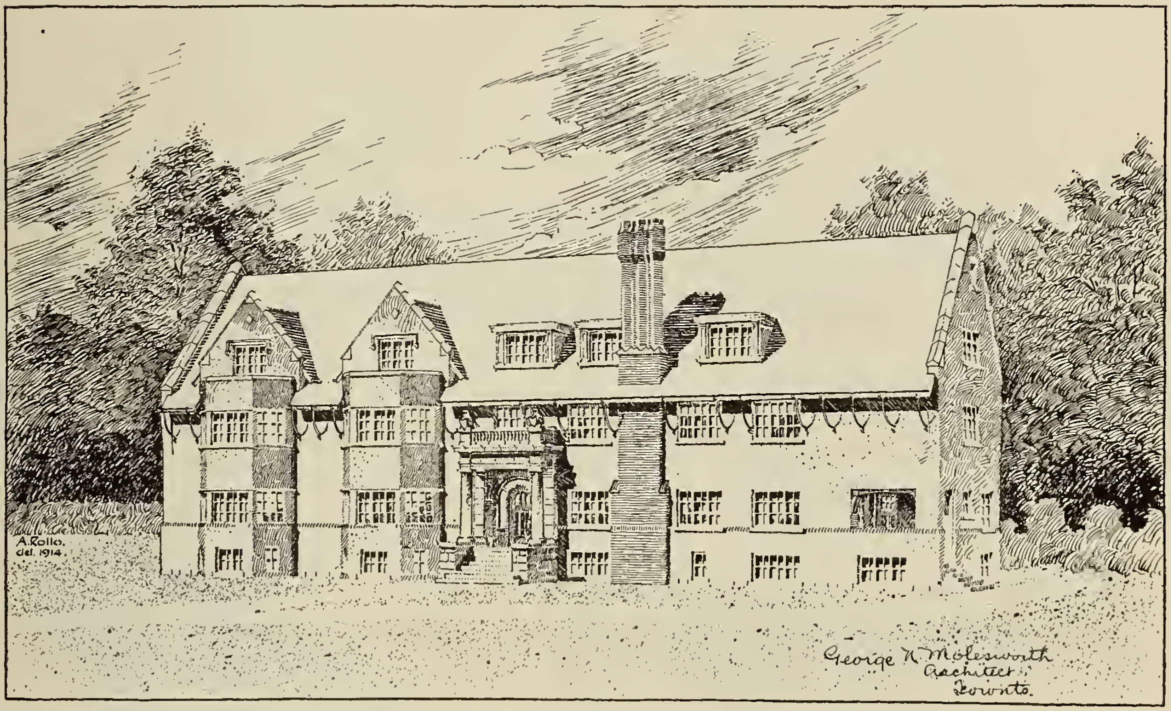
Denison Interlocking Hollow Tile, the modern building material, possesses bonding and interlocking properties unequalled by any other tile.

When Denison Tile is used in wall construction, there are no mortar joints extending through the wall to carry moisture. This feature, together with many dead air spaces, renders the Denison Tile wall impervious to moisture, heat, cold and sound.

Denison Hollow Tile is fireproof.



Eight Inch Wall



Orphanage for I.O.O.F. **BUILT LIKE A THERMOS BOTTLE** Oakville, Ont.

Architect:—Geo. N. Molesworth. Gen. Contractors:—Sutherland Construction Co.

SUN BRICK COMPANY, LIMITED

The One Price Company

Traders Bank Building **TORONTO, ONTARIO**

One Municipality Saved $92,000

By advertising their tenders in the "Contract Record." This page tells about it—briefly.

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

"Lack of Competition in City Works Has Much To Do with High Taxes."

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

> "I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being $92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

The "CONTRACT RECORD" saved this municipality $92,000 or 10% of the total contract. The advertisement cost $5.00. Would you rather have $5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

ESTABLISHED 1886

Contract Record and Engineering Review

220 King Street West, Toronto

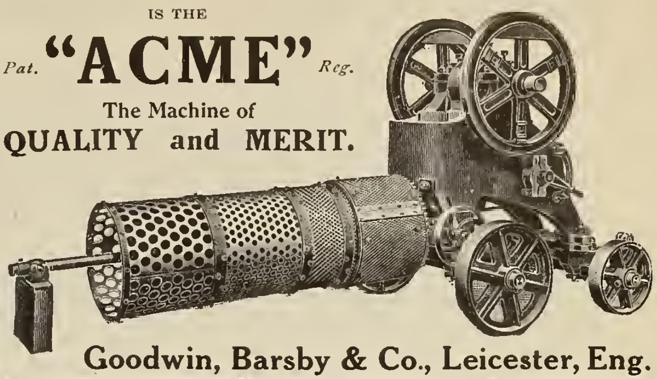
FOR SALE

One —55 Ton Switching Engine
One —35 Ton Vulcan Dinkey
Three—25 Ton 12 x 18 American Locomotive Co. Dinkies
Three—25 Ton 12 x 18 Vulcan Dinkies
Five —25 Ton Porter Dinkies
Two —10 x 16 Standard Gauge Vulcan Dinkies
One —10 x 16 36″ Gauge Porter Dinkey
Eighty—6 Yard K. & J. Dump Cars
Twenty—6 Yard Continental Dump Cars
Ten —4 Yd. Continental Dump Cars, 36″ gauge
Two Model 60 Marion Shovels
One —75 Ton Marion Shovel with extra high lift Boom
Two —Stone Crushers

Motors, all sizes, from 15 to 200 H.P., 3 phase, 440 volts to 2200 volts.

W. FRASER,
83 Craig St. W. MONTREAL

This **STONE CRUSHER** IS THE
Pat. **"ACME"** Reg.
The Machine of
QUALITY and MERIT.



Goodwin, Barsby & Co., Leicester, Eng.

Tenders

A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Aikenhead's

No. 408 Contractor's Forge

Full Line Blacksmith's Tools

CHAMPION BLOWER & FORGE CO. LANCASTER PA. U.S.A.
WHIRLWIND
TUYERE

This forge is very strong and durable specially adapted for general blacksmith work. It is equipped with No. 400 Blower, Whirlwind Tuyere Iron, and Half Hood, Hearth 30 x 36 in., Height 30 in., Weight 300 lbs.

Genuine Peter Wright Anvils and Leg Vises.

Aikenhead Hardware Limited, 17 Temperance Street
TORONTO

Current Prices of Building and Engineering Materials

General View of Market Conditions

THE situation in the constructional field throughout Ontario is much less unfavorable, generally speaking, than conditions a month ago forecasted. It would of course be useless to attempt to minimize the effects of the European war on trade as a whole and the resulting setback to the progress of building operations. An encouraging feature, however, is the fact that the tendency to panic has been but of momentary duration. Already there are well-defined reasons for believing that an appreciable amount of building work which had been postponed indefinitely, owing to the difficulty of financing the undertakings, will be carried through with as little delay as possible, the necessary facilities for overcoming the difficulty having been obtained. The opinion is held in many quarters that constructional work is being unnecessarily held up owing to diffidence on the part of the banks to supply loans on mortgages as heretofore. Consequently a lot of small and medium-sized building and speculative undertakings must go by the board. A reassuring feature of the situation is the determination of the Government and municipal authorities to proceed with public works as far as possible, while work on factory and other buildings in course of construction in Toronto and elsewhere is proceeding apace.

Regarding market conditions a feeling of increasing confidence pervades the principal manufacturers in Toronto. Trade in most departments is reported to be maintaining a comparatively fair level considering present conditions. Little change has taken place in the brick business since last report, the demand in most lines being slow. Hollow tile is reported in representative quarters to be in fair request but sewer pipe is slow, owing doubtless to the cancellation of much municipal work. The demand for lime is limited, due mainly to a slackening off in residential building operations. The market in structural steel is firm though demand is slow. Practically no change is noted in lumber. Business is fair in paints and oils though a lowering tendency in quotations has set in. The same is true of crushed stone, for which demand is fairly brisk.

At Montreal, the building trade is still in an unsatisfactory condition. There is, however, a more optimistic feeling as to business, and although nothing in the shape of a pronounced revival is to be expected, there is ground for believing that, with the giving out of a few fairly important contracts, the situation will not become worse during the remainder of the season. The Builders' Exchange have made efforts in the direction of inducing capitalists to recommence building operations on the basis of a lower cost; the unions, however, have strongly hinted that they are not inclined to take reduced wages, notwithstanding that some contractors are willing to undertake jobs at bare cost. As contracts are being finished, there is naturally a falling off in the demand for building supplies. The Canada Cement Company report a decline in orders, and Mr. F. J. Jones, the manager, states that the present output is more than is called for, the surplus being stored in the warehouses. Brick, too, has been a comparatively poor market, and the principal producer in the city has only one of its plants running. Crushed stone, sand, and gravel have shared in the slackening off. The lumber trade ness has brightened up a bit, and some retailers are doing a satisfactory turn-over.

The steel market shows hardening tendencies, but orders are by no means large. Rope continues firm, with a moderate business passing. With a normal trade, linseed oil is steady although it is expected that quotations will go higher.

At Winnipeg, the continuance of a large amount of development work carried on by the governments of the western provinces accounts for a large percentage of existing constructional activity, As regards the building and allied industries, however, the various supply houses which were anticipating the setting in of a gradual improvement in business conditions, due to the customary fall building activity, have not so far had their anticipations realized. The programme of construction has been curtailed by several of the public service corporations to the general detriment, and a certain inactivity in private enterprise at present prevails, though many projects under construction for private corporations have again resumed active work. In these circumstances it is only to be expected that the demand for supplies should be below the normal. The outlook for the immediate future is more or less uncertain, but at the same time there are many bright features in the situation, not the least important of which is the fact that government work is to be continued as far into the winter as conditions warrant. The present is no time for discouragement in view of the abundant wheat crop, coupled with the assurance of better prices, and the resulting circulation of a largely increased flow of ready money. This latter is almost certain to react to the advantage and benefit of manufacturers as a whole.

At Vancouver the market for practically all classes of materials has noticeably declined in activity owing to the effects of the European situation in almost every department of construction work. Municipal bodies in all parts of the province have been obliged to enter upon a policy of retrenchment, and until the outlook assumes a brighter aspect it is expected that no work other than what may be considered absolutely necessary will be undertaken during the fall and winter. Aside from the municipal field, however, there is a generally understood feeling here that such projects as have already been satisfactorily financed will be carried out without delay, and it is safe to assume that decisive action of this nature will do much to offset the difficulties of the present situation by promoting confidence in the future. In consequence of the lack of municipal activity the demand for crushed stone, sand, gravel, sewer pipe, etc., is at a comparatively low ebb. There is no evidence of any improvement having taken place in the steel business since last month, conditions on the whole remaining unchanged with prices about the same as previously quoted but inclined towards greater firmness. The movement of building lines has appreciably fallen off in the last few weeks, due in a large measure to the cancellation of considerable work pending more settled financial conditions. Enquiry at the present time is reported rather slow and dealers are inclined to the view that no immediate improvement may be looked for. The price of Welsh slate has advanced $1.50 since last review, and an advance of 5 cents is also noted for boiled and raw linseed oil. Sales of paints and oils have increased to some extent lately and it would seem that the prospects for a steady trade with householders this fall are reasonably assured. The movement of lumber is reported rather below the average this month and the market in all respects remains dull.

TORONTO PRICES

CEMENT, LIME, AND BRICK

Cement—delivered in 5-barrel lots, $1.85 per bbl.; car lots, $1.55 on the track, with pkgs. $1.95.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red brick, $18; buff, $18 f.o.b. the job; common red stock brick, $11 to $14; grey, $11 to $12; wire-cut brick for foundation work, $10.50 to $11 f.o.b. the job; No. 1 enamelled brick, all colors, from $75 to $140; tapestry brick, $20 to $30; sand-lime brick, $8.10, King Edward Siding; $7 at the mill; $9.50 delivered on the job. Smooth faced texture brick, $15; rough faced texture, $16 to $20, delivered any place in Ontario; paving brick, No. 1, $18 per M. f.o.b. West Toronto; No. 2, $14.00; paving blocks, No. 1, $24 per M.; No. 2, $18. Sun-Tex wall tile, $16 to $20 per M.; Denison interlocking hollow tile, $60 per M. Lots over 100,000, $55.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., $1.20; 1-in., $1.25; 3/8-in., $1.25; rubble stone, in car lots, $1.15 per ton f.o.b. car.

Sand—for cement or brick work, $1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to $1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—$1.50 per cu. yd., delivered.

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., $24; 18 ft., $26; 1-in. Hemlock No. 1 $25; No. 1 Hemlock decking $25 to $26; No. 2 hemlock, dimension and 1 in., $19 to $21.

Pine—1 in. common 6 to 12 in. wide (rough) $26 to $33; 2 in. white pine, bill stock, $28 to $34; 7/8 by 6 and 10 in. pine shelving, $33 to $42; 7/8 x 12 in. pine shelving $45; No. 1 white pine flooring $34; No. 1 spruce flooring $27.50; No. 1 pine decking D 2 S $28; spruce decking $27 to $30; No. 1 pine V. or beaded sheeting, $35; No. 2 ditto $32; pine trim 4 in. casing $1.75 per 100 ft.; 5 in. ditto $2; 8 in. pine base $2.75 to $3.25; 10 in. pine base, $3.40 to $4.50; 4 in. pine, window stool, $2.75.

Shingles—XXX B. C. shingles $3.60; N. B. extras $4; N. B. clears $3.45; No. 1 pine lath $5.50; No. 2 pine lath $4.75; No. 1 spruce lath $4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, $32; 10 x 16, 14 x 18, 16 x 18, $39; 8 x 16, 12 x 18, 18 x 18, $36; 16 x 18, 14 x 20, 16 x 20, $36.50; 8 x 18, 12 x 20, 18 x 20, $40; 10 x 20, $37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, $45; 12 x 22, $39; 10 x 22, $39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, $45.

STEEL AND IRON

Steel—(round and square bars) $2.50, base; twisted and deformed, $2.50; structural sections $2.50 to $3.

Galvanized iron—28 gauge $3.40.

Cast-iron pipe—Standard prices, carload lots, f.o.b. Toronto; 4-in. $34 per net ton; 6-in. to 12-in. $33; 12-in. up $32.50, with $1 extra for gas pipe.

Corrugated Iron—26 gauge $4.25 per sq., 28 gauge $2.50 to $3 per 100 pounds.

Steel channels and beams, angles and plates—$4.

SEWER PIPE

Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.25 ft.; all less 62 per cent.

SUNDRIES

Hard wall plaster—unsanded, from $8 to $8.50, bags extra; sanded $4, in car lots at the yard.

Hydrated lime—$9.25 to $10.25 in 20-ton car lots.

Plaster of Paris—Anchor, Crown, and Standard white brands, $1.50 per bbl.; Shield brand $1.25; New Brunswick $2.50.

Rope—manilla, 16c basis, second grade 13c basis, sisal rope, 10½c basis; African rope 13c.

PAINTS AND OILS

White lead—ground in oil, $9 per 100 lbs.

Boiled linseed oil—in bbls., 66c per gal. of 9 lbs.

Raw linseed oil—in bbls., 63c per gal.; red lead, dry, $8 to $9 per 100 lbs.; putty in bulk, bbls., 3½c.; putty in 25-lb. tins, 4c.; turpentine, in bbls., 65c.

MONTREAL PRICES

CEMENT, LIME, AND BRICK

Cement—$1.90 steam car load lots, including sacks.

Lime—Hydrated, $14 per ton; lump, $10.

Brick—No. 1 pressed, $17; No. 2 pressed, $15; Manganese rustic, $20; buff rustic, $20; red rustic, $14; buff (smooth), $21; buff (rough), $25; plastic, $8.50, C. P. R. 50c extra except for plastic. Dominion silicate, 1st quality, $13; second quality, $10.50; all f.o.b. Montreal.

Concrete Brick—grey $22, red $22, buff $23, white $45, plain pressed $12 per thousand, all f.o.b. Montreal. Quotations f.o.b. Toronto:—White $52, buff $28, grey $27, plain pressed $17, red $27.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $1.40; ¾-in., $1.65; ⅜-in., $1.75, per ton, delivered.

Sand—95c per ton, car loads, on cars.

Gravel—$1.35 per ton f.o.b. cars.

(Continued on page 72)

RAILS **BILLETS**

Concrete Reinforcement Bars

Plain Round, Square and Cold Twisted Squares

DOMINION IRON & STEEL COMPANY
LIMITED

BAR STEEL

Warehouse Stocks:
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TORONTO, ONT.
FT. WILLIAM, ONT.

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WIRE NAILS and other **WIRE PRODUCTS**

MEXICAN EAGLE ASPHALT

TRADE MARK

Delivered to meet the specifications of the American Society for Municipal Improvements, the Association for Standardizing Paving Specifications or any other standard specifications

Purchase MEXICAN EAGLE ASPHALT because:

1—It is more cementitious than other asphalts.
2—Water will not readily injure it.
3—Exposure to sun and air will not cause its deterioration.
4—It has great cohesive strength.
5—It is more ductile and flexible than other asphalts.
6—Shocks will not crack it. It is very malleable.
7—We will supply asphalt having the proper penetration for your needs.
8—It is best adapted to Canada's climate—will not mark in hot weather—nor are snow or ice likely to crack it
9—It has over 99 per cent. bitumen. Purest on the market—therefore free from deleterious matter.
10—It is so constituted that it will not be injured by the heat necessarily applied to melt it for paving operation.

Samples, prices, analyses, etc., on request

The Asphalt and Supply Co., Limited

Sole Canadian Agents for the Mexican Eagle Oil Co. Limited

103-107 Board of Trade Building :: MONTREAL

CURRENT PRICES OF BUILDING AND ENGINEERING MATERIALS—continued.

(Continued from page 70)

EXPLOSIVES

Forty per cent. dynamite $16.25 per 100 lbs. in single case lots of 50 lbs. each; 50 per cent. at $17.75; 60 per cent. at $19.25, f.o.b. Montreal. Blasting at $2 per 25 lb. keg. Detonators, No. 3 at 75c per 100; No. 6 at $1 per 100. Batteries, No. 2, rated capacity up to ten fuses, $13.50 each; No. 3, rated capacity up to 20 fuses, $20.50 each; No. 4, rated capacity up to 50 fuses, $41 each. Leading wire, in coils of 500 ft., 1c per ft.; leading wire, twin cable, in coils of 250 ft., 3c per dble ft.; connecting wire in coils or spools, 50c per lb. Electric fuses, 4-ft. single strength, per 100, $3; 4-ft. double strength, per 100, $3.50; 6-ft. single $3.54; double, $4.04; 8-ft. single $4.08; double $4.58; 10-ft. single $4.62; double $5.12; 12-ft. single $5.16; double $5.66; 14-ft. single $5.70; double $6.20; 16-ft. single $6.24; double $6.74; 18-ft. single $6.78; double $7.28; 20-ft. single $7.32; double $7.82; 22-ft. single $8.32; double $8.82; 24-ft. single $9.32; double $9.82; 26-ft. single $10.32; double $10.82; 28-ft. single $11.32; double $11.82; 30-ft. single $12.32; double $12.82.

STEEL AND IRON

Steel angles—3-in. x 3-in. and up, $2.75; 1-in. x 1-in. x ⅛-in., 25c extra; ¾-in. x ¾-in. x ⅛-in., 50c extra. Boiler plates—¼-in. thick and thicker, $2.50. Circular plates—Flange quality, 30-in. dimensions and over, $2.60; under 30-in. dimensions, $2.90. Beams and channels—Under 35 lbs. per yd., $2.90; 35 lbs. per yd. and over, $2.75, f.o.b. Montreal, net cash. Corrugated iron—26-in. gauge, $4.25; 28-in. $4 per sq. yd. less 10 and 10 per cent. Copper bearing sheets—flat, Apollo Keystone galvanized, 28 U. S. gauge, $4 per 100 lbs.; Keystone black, 28 U. S. gauge, $2.75 per 100 lbs.

SEWER PIPE

Straight pipe (per foot)—4-in., 25c; 6-in. 40c.; 8-in., 55c; 9-in., 70c; 10-in., 80c; 12-in., $1; 24-in., $3.25. Bends, each, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Double collar, 75c, $1.20, $2.20, $2.80, $3.20, $4.00, $13. Single branch, 2 ft., $1, $1.60, $2.50, $3.15, $3.60, $4.50, $16.25. Double branch, 2 ft., $1.75, $2.80, $3.85, $4.90, $5.50, $8, $26. Y. Pipe, 2½ ft., $2, $3, $4.12, $5.25, $6, $8.50, $27.60. Syphon, $2.25, $3.60, $6.60, $8.40, $9.60, $15, (12-in.). Buchan trap cesspools, double syphon, running trap and hand-hole trap, $2.25, $3.60, $6.60, $8.40, $9.60, $15 (12-in.) These prices are subject to a discount of 50 per cent.

SUNDRIES

Hard wall plaster—$11.00 per ton. Plaster of Paris—$2.35 per bbl. Rope—Best Manilla, 16c basis per pound; Bsitish manilla, 13c basis; African hemp, 13c; sisal rope 10½c basis. Boiled linseed oil—in barrels, 60c per gal. of 9 lbs. Raw linseed oil—in barrels, 62½c per gal.

WINNIPEG PRICES

CEMENT, LIME AND BRICK

Cement—Delivered in 5-bbl. lots, $2.60; in car load lots, $2.30.

Lime—Grey, 34 cents per bushel; white, 32 cents.

Brick—No. 1 dry pressed, red and buff, $30 to $40; common red stock, $25; common grey stock, $12; No. 1 enamelled brick, all colors, from $100; sandlime, $12; firebrick, $52.50.

CRUSHED STONE, SAND AND GRAVEL

Crushed Stone—2-in., $2.65 per yd.; 1-in., $2.90; 3/8-in., $2.90; rubble stone, car load lots, delivered, $13 per cord.

Sand—For cement or brick work, delivered, Winnipeg, $1.85 per cu. yd.

Gravel—Per yd., delivered, $1.85.

LUMBER (BUILDING MATERIAL)

(15 per cent. discount for cash)

Flooring—No. 2 red pine, 4 in., $43; 6 in., $46; No. 3 red pine, 4 in., $38; 6 in., $40; No. 4 red and white pine or spruce, 4 in., $28; 6 in., $32; No. 1 and 2 fir, edge grain, 3 in., $60; 4 in. and 6 in., $55; No. 3 fir, edge and flat grain, 4 and 6 in., $45; No. 4 fir, shiplap grade, 4 and 6 in., $32; common 2 x 6 pine, spruce or fir, 4 and 6 in., $33; No. 2 white pine, 4 and 6 in., $55; No. 3, $45; No. 2 red pine, 4 and 6 in., $46; No.. 3, $40; No. 4, $32; No. 5, $24.

Dimension Timber (No. 1 pine, spruce, tamarac, fir or cedar)—8 x 8, 8 x 10, 10 x 10, 10 x 12, 12 x 12, $38; 10 x 14, 14 x 14, 14 x 16, 6 x 10, 6 x 12, 8 x 12, $39; 10 x 16, 12 x 16, 16 x 16, 14 x 18, 16 x 18, 18 x 18, 20 x 20, $40; 6 x 14, 8 x 14, 12 x 18, 18 x 20, $42; 6 x 16, 6 x 18, 6 x 20, 8 x 16, 8 x 18, 8 x 20, 10 x 18, 10 x 20, 12 x 20, 14 x 20, 16 x 20, $43.

Pine—1-in. common, 6 to 10 in., $105; 12 in., $110; pine trim 4-in. casing, $3.70 per 100 ft., 5-in. ditto, $4.40; 8-in. pine base, $6; 10-in., $7; 4-in. pine window stool, $7.50.

Shingles—No. 1 B. C. cedar, $4; No. 2, $3.50; No. 1 B. C. cedar dimension, $5.50; band-sawn, $7.

STEEL AND IRON

Steel—Round bars, $2.35 per 100 lbs.; square twisted, $2.45 per 100 lbs.; channels, angles, beams and plates, $2.95 per 100 lbs.

Cast Iron Pipes—Standard price, car load lots, f.o.b. Winnipeg, $50 per ton.

SEWER PIPE

Sewer Pipe—Wholesale prices f.o.b. Winnipeg, per ft., 3 in., 9 cents; 4 in., 11 cents; 5 in., 16 cents; 6 in., 18½ cents; 8 in., 30 cents; 10 in., 40 cents; 12 in., 50 cents; 18 in., $1.00; 24 in., $2.00.

SUNDRIES

Hard Wall Plaster—Unsanded, $13 per ton; sanded, $7.50, delivered on job. Plaster of Paris, $15.50 per ton; Hammer Brand, $3.75 per bbl.

PAINTS AND OILS

Paints and Oils—White lead, ground in oil, $8.50 per 100 lbs.; boiled linseed oil, in bbls., 73 cents per gal.; raw linseed oil, in bbls., 70 cents per gal.; dry red lead, $8 per 100 lbs.; putty in bulk, $2.75 per bbl.; putty in 25-lb. tins, $3.10; turpentine, in bbls., 80 cents per gal.

VANCOUVER PRICES

CEMENT, LIME AND BRICK

Cement—Common, $2.35 per bbl. f.o.b. warehouse; Keens cement, $32 per ton, sacks extra; fine white, $7.50 per bbl. of 300 lbs.; superfine, white, $9.50 f.o.b. Vancouver; white Portland cement, $8 per bbl. of 380 lbs., sacks 10c extra, f.o.b. Vancouver.

Lime—$1.35 per bbl. f.o.b. warehouse or delivered.

Brick—Common red brick, $13 f.o.b. warehouse, $11.50 in car lots f.o.b. Vancouver; pressed red and buff brick, $42 at warehouse, $40 in car lots; white enamelled brick, No. 1 quality $100 to $120 at warehouse; tapestry brick, $60 to $80 at warehouse; impervious brick, $70 f.o.b. buildings.

CRUSHED STONE, SAND AND GRAVEL

Crushed stone—2-in., $1.40; 1-in., $1.50; 3/8-in., $1.50, all f.o.b. scows.

Sand—Brick and plaster sand 90c per cu. yd. f.o.b. bunkers.

Gravel—$1.40 per yard delivered.

LUMBER (BUILDING MATERIAL)

Vancouver prices f.o.b. mills:

Timber (B.C. fr)—all sizes up to 12 x 12, $12; up to 14 x 14, $13; sizes from 16 x 16 to 20 8 x 20, $15, squares.

Common fir, cedar, hemlock and spruce—small dimensions, up to 20 feet, $12; 22 to 32 feet, $14; boards and shiplap, $12; No. 1 and 2 edge grain flooring, ceiling and siding, $30; No. 1 and 2 flat grain flooring, ceiling and siding, $25; No. 1 XXX. B. C. shingles, $2.10; fir lath, $2.

STEEL AND IRON

Vancouver prices f.o.b. warehouse;

Steel—(round and square bars) $2.65 base; twisted and deformed, $2.90; structural sections $3.25 to $3.75.

Galvanized iron—28 gauge, $4.85 per 100 lbs.

Corrugated iron—26 gauge, 6, 7 and 8 ft. sheets $4.20, 9 and 10 ft. sheets, $4.35 per square. Black steel sheets, 24 gauge, $3.10 per 100 lbs.

Steel channels and beams, angles and plates—$3.25 to $3.75 per 100 lbs., depending on size, quantity and specifications.

SEWER PIPE

Sewer pipe—Vancouver prices, f.o.b. warehouse, 4-in., 25c. per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., $1 ft.; 15-in., $1.40 ft.; 18-in., $1.90 ft.; 20-in., $2.25 ft.; 24-in., $3.60; all less 40 per cent.

SUNDRIES

Hard wall plaster—$13.50 to $15.00, in car lots f.o.b. Vancouver, bags extra.

Hydrated lime—$14 in car lots.

Plaster of Paris—Hammer brand, $4 per bbl.

Welsh slate—$12.00 to $12.50 per square, f.o.b. Vancouver.

Rope—Manilla, full coil, 15½c basis; 2nd grade, 14½c basis; sisal rope, 11½c basis.

PAINTS AND OILS

Mixed paint—per gal. $2.50.

White lead—ground in oil, $10.25 per 100 lbs.

Boiled linseed oil—in bbls., 95c per gal. of 9 lbs.

Raw linseed oil—in bbls., 93c per gal.; red lead, dry, $8.00 to $9.00 per 100 lbs.; putty in bulk, bbls. 3c; putty in 25-lb. tins, 4c.; turpentine in bbls., 95c.

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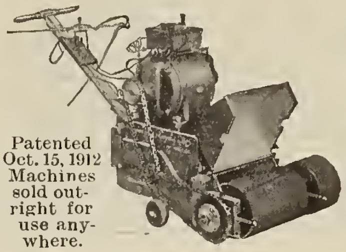

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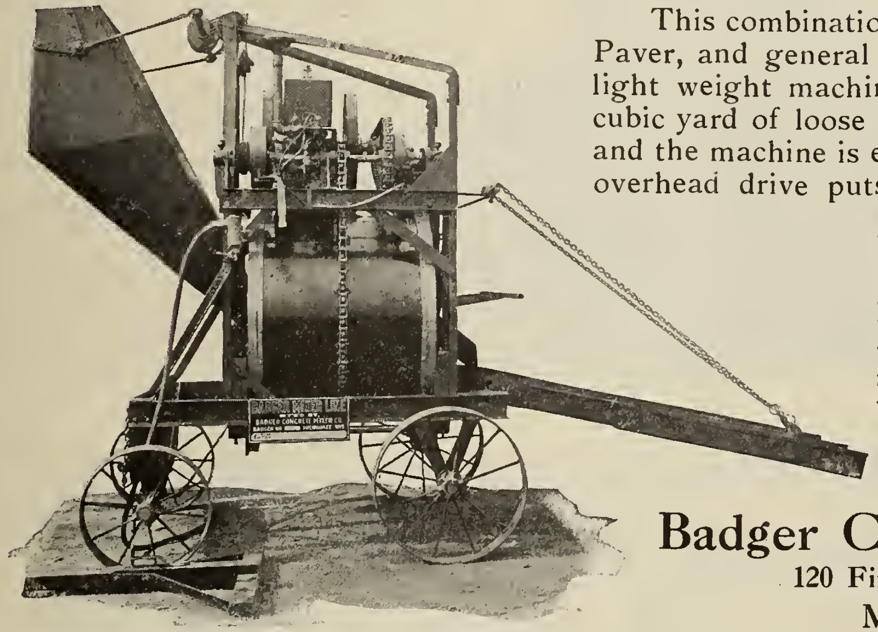

This combination Badger Road Builder, Street Paver, and general purpose Mixer, is an all-steel, light weight machine, with a capacity of one-half cubic yard of loose material. The wheels are high and the machine is easily moved by two men. The overhead drive puts the engine out of the way, enabling the crew to work on all sides. The Badger is the simplest, strongest and best designed road builder and street paver on the market. This is the only Mixer that will meet all the various requirements of the contractor for efficiency and general utility. No vibration.

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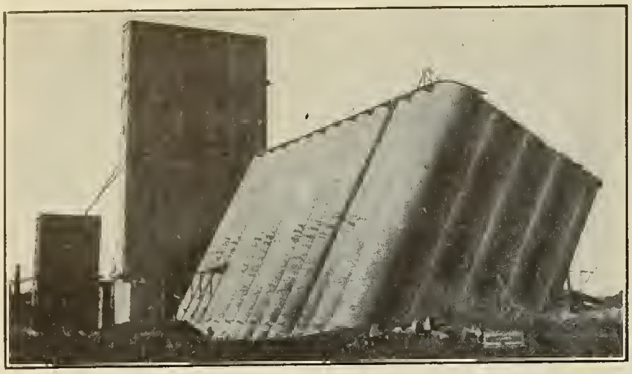

NOTICE

The building in the illustration, built of concrete, was righted to its proper position without damage to structure.

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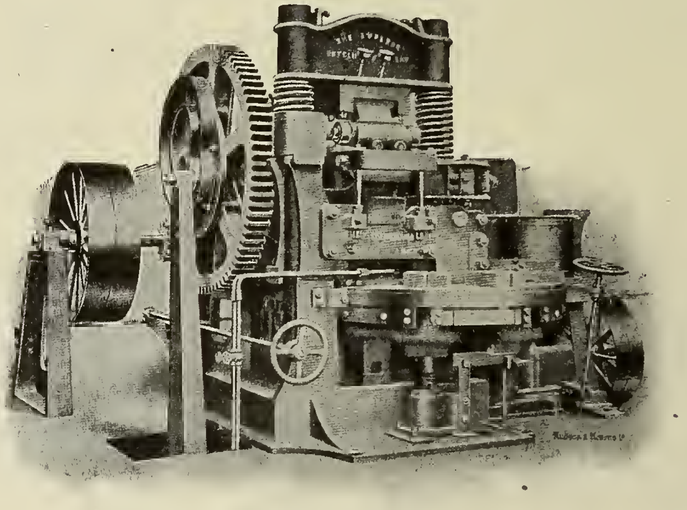

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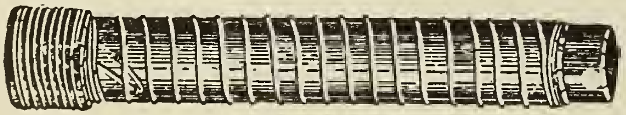
CABLES—"Utilization Leigh" CODES—A B C. 5th Edn. McNeill 1899 Edn. **LANCASHIRE, ENG.**



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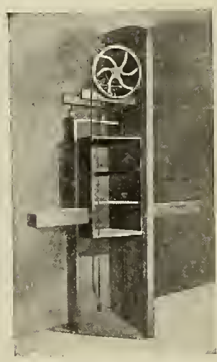

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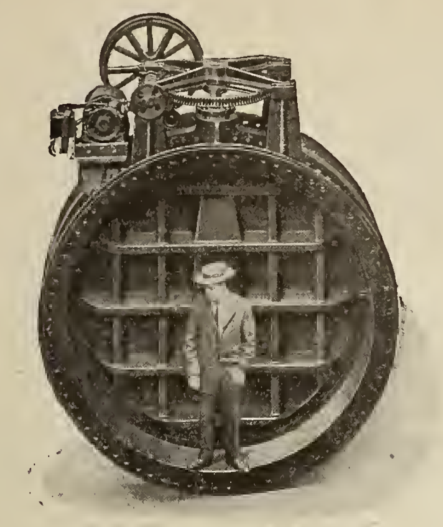

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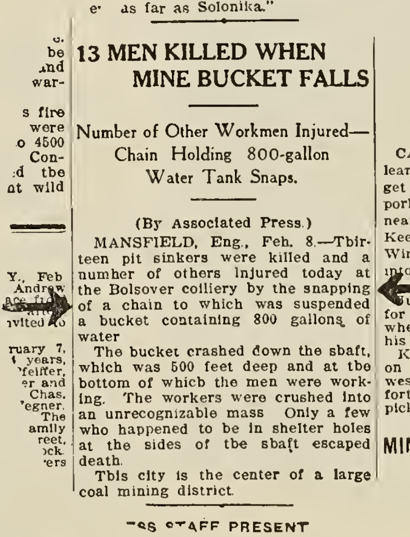

nicely by the old privileges. I took a horse through Central Macedonia. as far as Solonika."

13 MEN KILLED WHEN MINE BUCKET FALLS

Number of Other Workmen Injured—Chain Holding 800-gallon Water Tank Snaps.

(By Associated Press.)

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The bucket crashed down the shaft, which was 500 feet deep and at the bottom of which the men were working. The workers were crushed into an unrecognizable mass Only a few who happened to be in shelter holes at the sides of the shaft escaped death.

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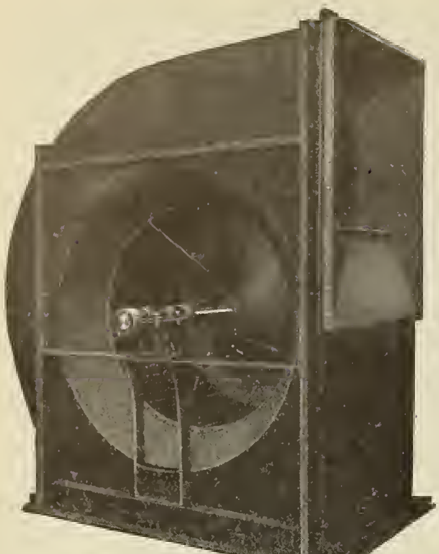

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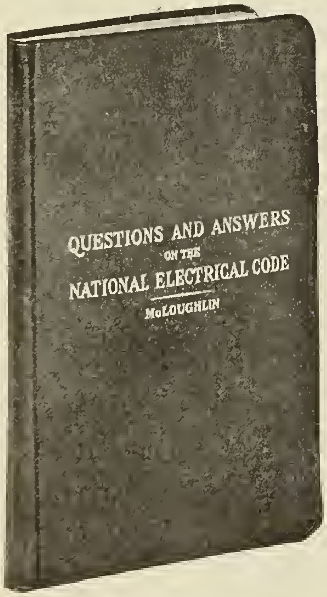

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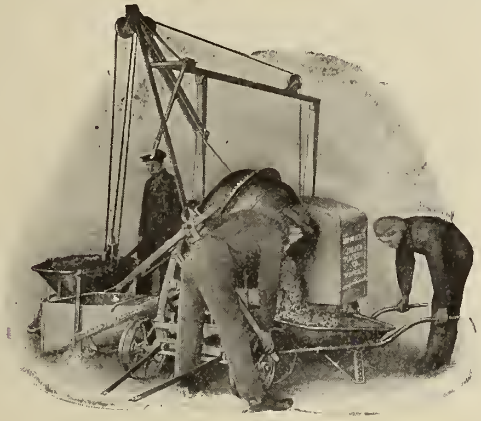

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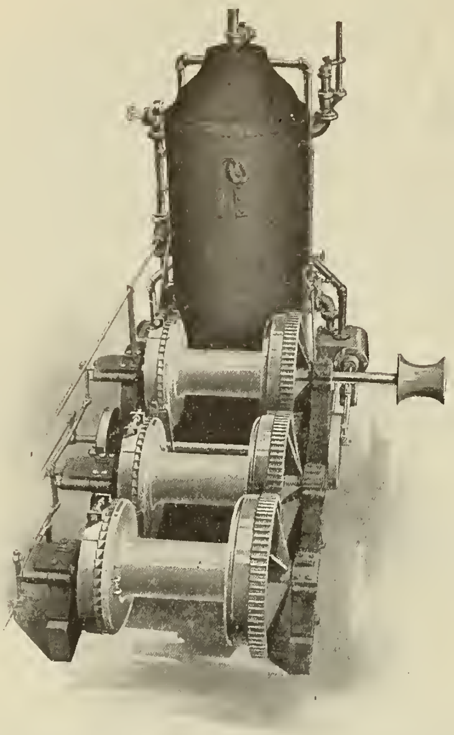

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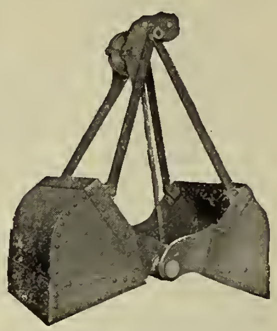

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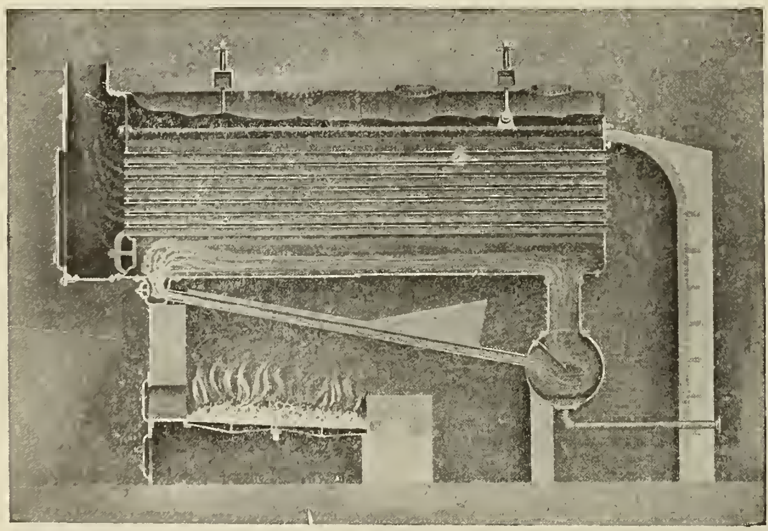

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See Bulletin 510

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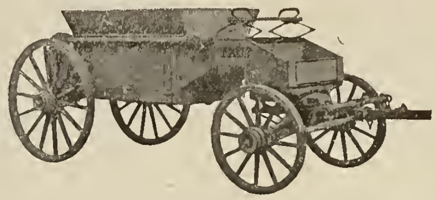

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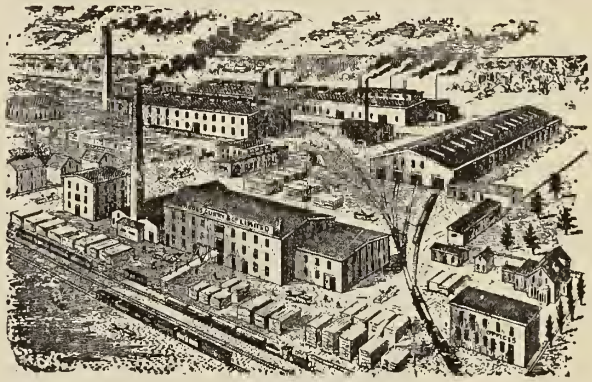

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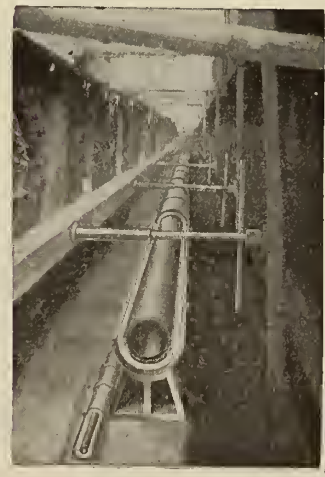

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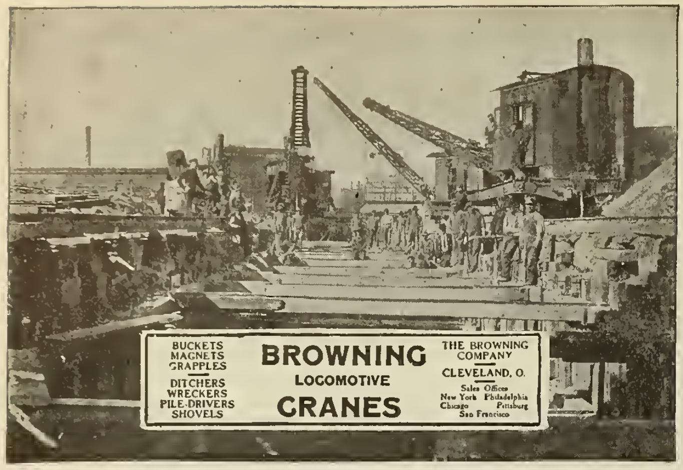

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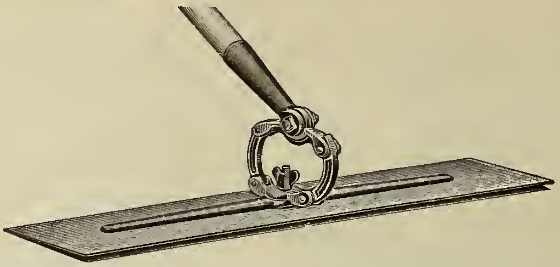

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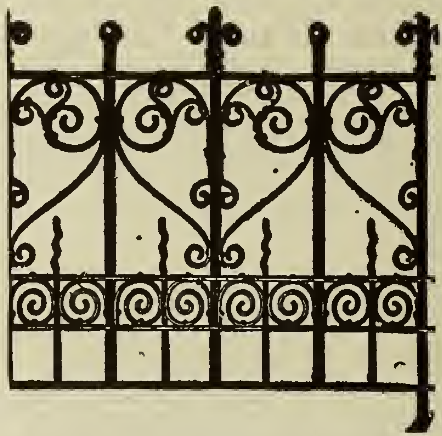

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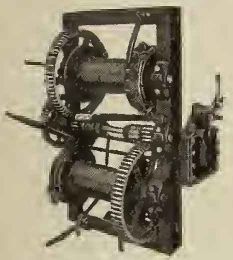

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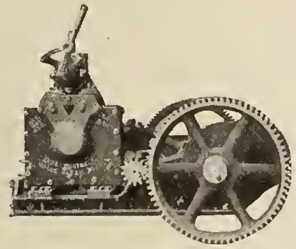

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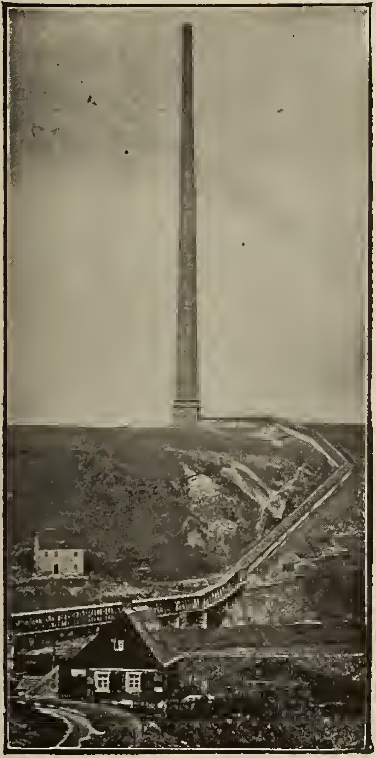

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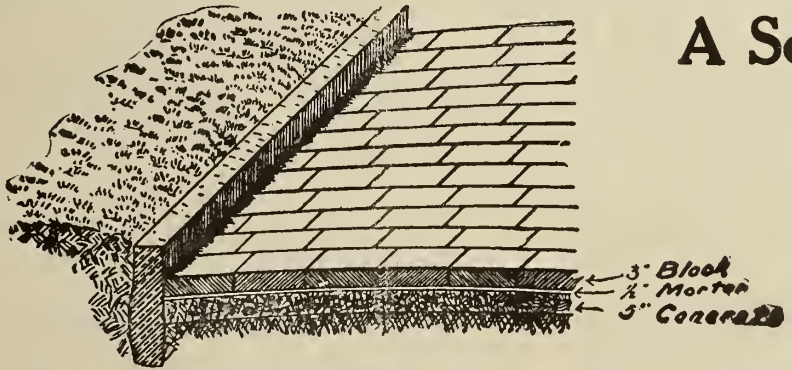

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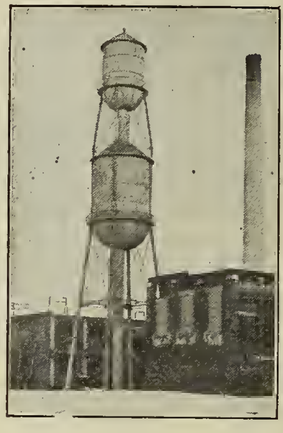

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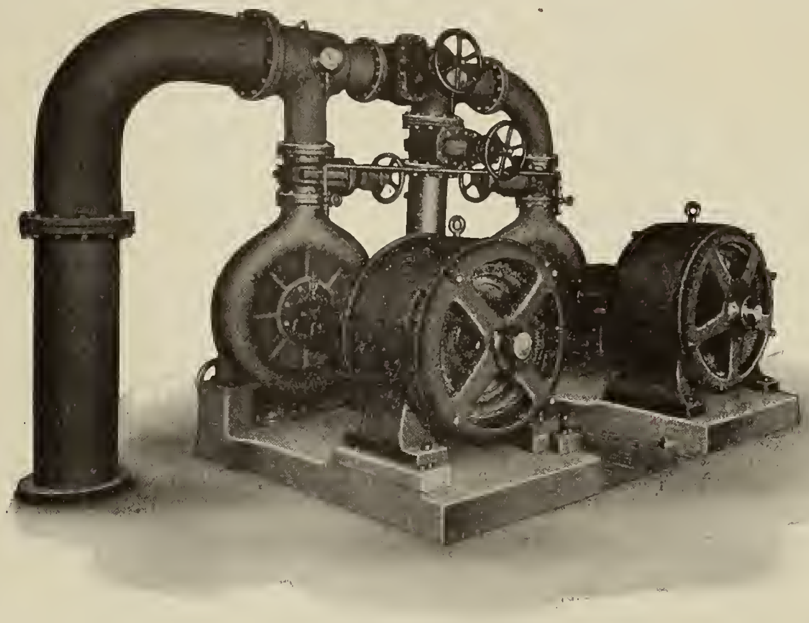

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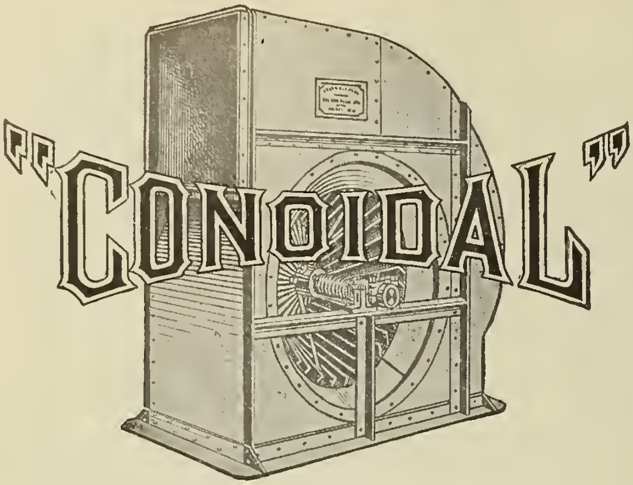

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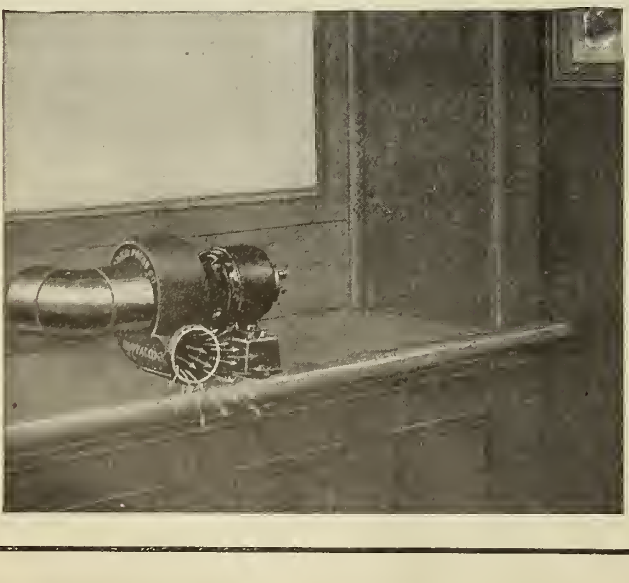

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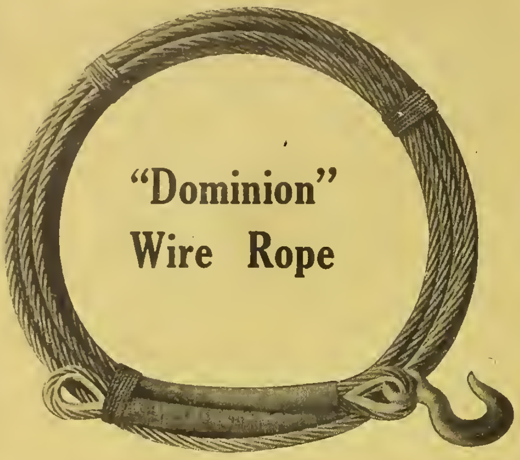

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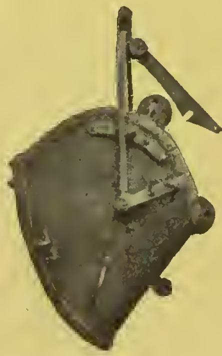

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